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ARTICLES

RESISTANCE OF ANOPHELINES TO CHLORINATED INSECTICIDES IN GREECE

GREGORY LIVADAS,[1] M.D., M.P.H.

After the generalized campaign with DDT launched in Greece in 1946 by the Malaria Division of the Athens School of Hygiene, various domestic insects (housefly, *Culex molestus, Pulex irritans*), which had originally disappeared from DDT-sprayed quarters, showed, consecutively, during the immediately following years resistance to this insecticide (1, 2, 3). However, no hint had ever been made in any communication until 1951 of any kind of resistance to DDT by anophelines. In the autumn of that year, from personal communications by sanitary inspectors working in the field it was for the first time brought to our attention that in certain areas of Greece, where the amended malaria control program we had prepared was carried out, especially in Peloponnese, an unusual anopheline density was observed in DDT-sprayed quarters at varying intervals.

After a thorough check was made of these communications, we considered it advisable, owing to the importance of the subject, to present those observations, with all possible reservation, in a preliminary communication to the Malaria Section of the World Health Organization, which was circulated as WHO/Mal/74 Doc. on Dec. 18, 1951, under the title "Do Anophelines Acquire Resistance to DDT?"

In the following year (1952), we proceeded, with our associate Dr. Georgopoulos, to a more specific investigation of the above problem in an area of Peloponnese (Scala-Laconia). From the above investigation, it was ascertained experimentally that in two villages of that area (Asterion and Souli), *A. sacharovi* had developed a clear physiological resistance to DDT and gammexane (5), and that in another village of the same area (Leimonas), the resistance of *A. sacharovi* had also extended to chlordane (6).

In this way, the development of resistance to chlorinated insecticides by one anopheline species in Greece was for the first time brought to light. The above observations made clear the necessity of studying the phenomenon in other areas of the country and of looking into its possible consequences on malaria incidence in Greece. To this end, an extended investigation program was worked out, which included: (1) the carrying out of epidemiological surveys in various areas of Greece, and (2) the determination of the degree of resistance eventually developed by the local vectors to chlorinated insecticides, through appropriate experiments and tests.

The results of the investigations are summarized below.

The findings of the epidemiological survey made in 1953 and 1954 were as follows:

(1) Besides Scala area, in other areas of Greece also (Drama, Cavalla etc.) *A. sacharovi* is very little, if at all, affected by DDT house spray.

(2) It was also observed that the effect of sprayings, repeated twice or three times in the same malaria season with alternately used chlorinated insecticides (DDT, chlordane, gammexane etc.) on *A. Sacharovi* density in various areas of Greece (Salonica, Serres, Chalkididi, Elia, etc.) was a very moderate one, if any.

(3) The other two local vectors (*Anopheles superpictus* and *A. maculi-*

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pennis) were also very little affected by chlorinated insecticides.

(4) The development of resistance to chlorinated insecticides by anopheline vectors in some areas was followed by an obvious increase in malaria cases, while, in others, it resulted in an increase of malaria incidence assuming sometimes the character of local epidemic outbreaks.

(5) The aforementioned epidemic outbreaks were exclusively due to *Plasmodium vivax*. On the other hand, *P. falciparum* cases were sporadic and there was no indication whatever of noticeable reconstruction of the cycle of the latter plasmodium.

A more detailed investigation made concurrently (7) in 1953 and 1954 on the effectiveness of chlorinated insecticides in stables sprayed experimentally in an area of Greece (Scala-Laconia), gave the following results:

(1) *A. sacharovi* density * in a DDT-sprayed stable † was high from the first 5-day period after spraying, and rose quickly to the control levels during the subsequent two 5-day periods. The mortality of *A. sacharovi* caught in the above stable after a 24-hour stay in the cages was low from the first 5-day period after spraying (35.7%), and decreased to 23.7 per cent during the second 5-day period and to 23.9 per cent during the third 5-day period.

(2) *A. sacharovi* density, although it had a considerable decline in a chlordane-sprayed stable †† during the first 5-day period after spraying, showed an abrupt rising during the second 5-day period after spraying with this insecticide, and during the subsequent 5-day periods the fluctuations of mosquito density were practically the same as those observed in the control (Fig. 1). On the other hand, the mortality of *A. sacharovi* caught in the chlordane-sprayed stable after their 24-hour stay in the cages, was already from the first 5-day period after spraying about the same as that observed in the control (Fig. 2).

(3) Dieldrin, though clearly more effective than DDT and chlordane, also showed reduced action. From the first 5-day period, *A. sacharovi* catches in a dieldrin-sprayed stable ††† were positive and during the fourth 5-day period after spraying, there was an evident increase in the mosquito density (Fig. 1). The mortality of mosquitoes caught in the above stable after their 24-hour stay in the cages remained at relatively high levels during the first two 5-day periods after spraying; thereafter there was an abrupt decline (Fig. 2).

(4) The diazinon-dieldrin combination seems to be superior to dieldrin, individually applied. The mortality of *A. sacharovi* after spraying with the above combination,‡ after their 24-hour stay in the cages, was 100 per cent during the first 5-day period and 86.9 per cent during the second 5-day period after spraying. Thereafter, in this case also, there was an abrupt decline in mortality (Figs. 1 and 2).

On the other hand, from an investigation (8) made in three areas of Greece by topical application to adult *A. sacharovi* and *A. maculipennis* with microdoses of DDT, in accordance with the Ludwik technic (9) and by the application of Buswine and Nash method (10) on a total of 21,723 *A. sacharovi* and 1448 *maculipennis* tested, there were the following findings:

(1) The LD_{90} DDT on *A. sacharovi* in the village of Elos of Scala area in 1953 was 0.36 microgram per mosquito. In 1954, in the same village the LD_{90} DDT on *A. sacharovi* amounted to 0.48 microgram per mosquito (Fig. 3).

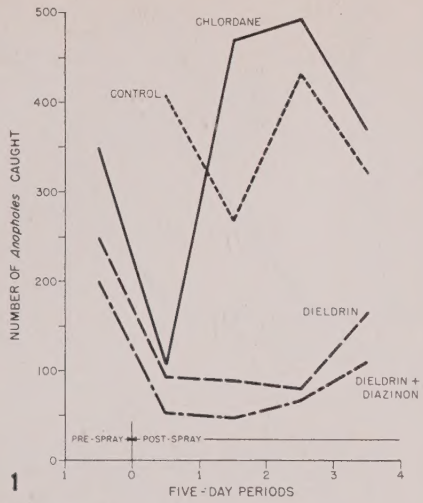
* The estimation of the vector density was in all cases made on the basis of daily catches of a 15 minutes duration always carried out by the same person.

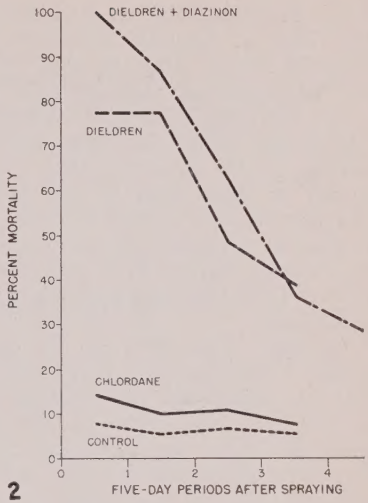
† Dose of DDT used: 2.0 gr. active ingredient per square meter.

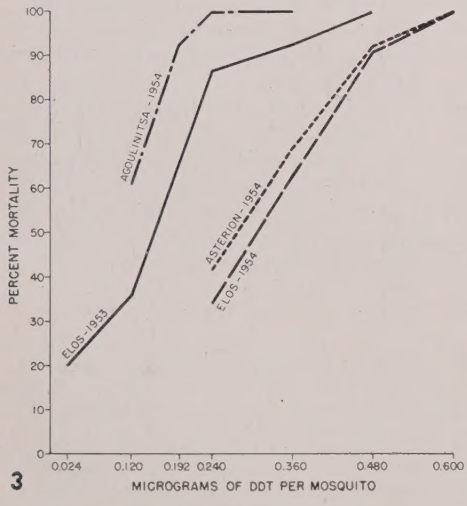
†† Dose of chlordane used: 1500 mg. act. ingred. per sq. meter.

††† Dose of dieldrin used: 400 mg. of act. ingred. per sq. meter.

‡ Dose used: 320 mg. diazinon and 250 mg. dieldrin per sq. m.







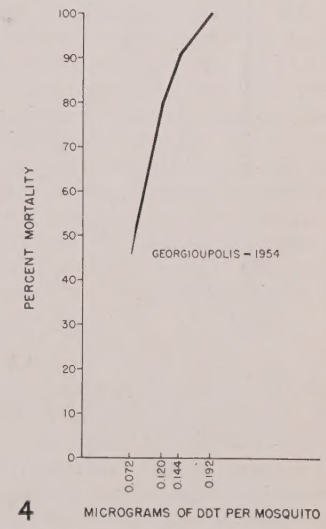


FIG. 1. Density of *Anopheles sacharovi* in stables sprayed with different insecticides and in an unsprayed stable (control). Asterion, Aug.-Sept. 1954.

FIG. 2. Twenty-four hour mortality of *Anopheles sacharovi* caught in stables sprayed with different insecticides and in an unsprayed stable (control). Asterion, Aug.-Sept. 1954.

FIG. 3. Twenty-four hour mortality of *Anopheles sacharovi* (adults) after topical application of different microdoses of DDT (expressed in micrograms per mosquito).

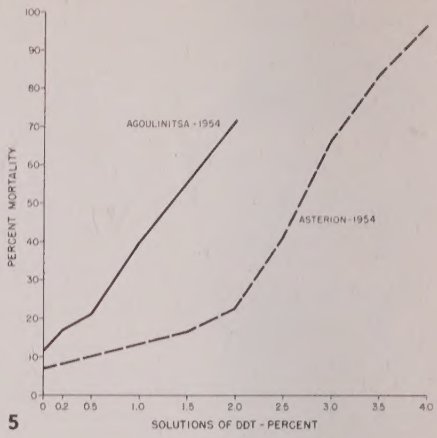
FIG. 4. Twenty-four hour mortality of *Anopheles maculipennis* (adults) after topical application of different microdoses of DDT (expressed in micrograms per mosquito).

(2) The LD_{90} DDT on *A. sacharovi* in the village of Asterion, located 2 kilom. from the former village, in 1954 was also 0.48 microgram per mosquito (Fig. 3).

(3) The LD_{90} DDT on *A. sacharovi* in Agoulinitsa (Elia) in 1954 was 0.19 microgram per mosquito (Fig. 3). It should be noted that in this area of Peloponnese, from recently made epidemiological investigations, it was found that *A. sacharovi* showed clear resistance, not only to DDT, but also to chlordane and gammexane.

(4) The LD_{90} DDT on *A. maculipennis* in Georgioupolis (Crete) in 1954 was 0.14 microgram per mosquito (Fig. 4). In this area, although the house spray carried out by the malaria control service has been suspended since 1951, the population is said to continue privately, from time to time, the use of chlorinated insecticides, with a view to getting rid of the nuisance of the domestic insects.

(5) The average mortality, after 24 hours, of *A. sacharovi* exposed to a 2 per cent DDT solution for 60 minutes, in accordance with the Buswine and Nash method, amounted in Agoulinitsa, in 1954, to 71.2 per cent. In the same year, in the village of Asterion the average mortality of *A. sacharovi* exposed to a 2 per cent DDT solution for 60 minutes, after 24 hours, was 22 per cent. It rose to 96.9 per cent after exposure to a 4 per cent DDT solution (Fig. 5).


PERCENT MORTALITY
AGOULINITSA - 1954
ASTERION - 1954
SOLUTIONS OF DDT - PERCENT
0 0.2 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
0 10 20 30 40 50 60 70 80 90 100

5

FIG. 5. Twenty-four hour mortality of *Anopheles sacharovi* (adults) after exposure of one hour to different solutions of DDT in paper-lined vials.

CONCLUSIONS

From the investigations made in Greece during the period 1952–1954, the following conclusions can be drawn:

(1) Malaria vectors, particularly *A. sacharovi,* developed clear physiological resistance to DDT and other chlorinated insecticides. This fact had a varying effect on malaria incidence in Greece, at various intervals.

(2) Measurement of the degree of resistance developed by *A. sacharovi* to DDT is not possible, due to the lack of data regarding the degree of susceptibility showed by this species during the initial stages of the application of above insecticide.

(3) The degree of resistance to DDT developed by *A. sacharovi* varies from area to area and tends to increase from year to year.

(4) The minimum LD of DDT found in Greece on *A. sacharovi* (0.19 microgram per mosquito) is larger than that found for *A. maculipennis* (0.14 microgram per mosquito), and is very probably larger than even the LD of DDT on the susceptible strains of *A. sacharovi.*

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JEEP MOUNTED MIST BLOWER

G. PAUL JONES

Manager, Marin County Mosquito Abatement District

The Marin County Mosquito Abatement District has built and has been using a one-man operated mist blower. This rig is a self-contained unit and is operated by the driver of the jeep. Most of the important features can be seen in the 2 views shown in Figure 1.

The motor, blower, and pump are mounted on a ¼-inch steel plate, 12″ x 36″. This plate is fastened by four bolts and is placed over the left rear fender of the jeep. Originally, the jeep had two extra leaves in each rear spring. After installation of the mist blower, it was found that two additional leaves had to be added to the left rear spring.

A 4½ HP Lawson gasoline engine (4-cycle, 1 cylinder) is placed directly behind the left side of the cab of the jeep. The power is supplied to the pump and blower by pulleys and belts.

A ½-inch Flex-Roller pump is mounted beside the blower with a bypass. It pumps insecticide from a 50-gallon tank located in the center of the jeep directly behind the cab. The liquid is pumped through a flexible rubber tube to the discharge end of the blower. A removable #5 whirljet nozzle is firmly attached near the center of this discharge pipe and sprays the material into the air stream. The insecticide is pumped at the rate of about one gallon per minute. A valve in this line controls the spray; it is operated by a lever from the driver's seat.

The blower is a war surplus unit and puts out approximately 600 cubic feet per minute at 4200 rpm. It is attached immediately behind the motor and blows toward the rear of the jeep. The discharge opening is 4″ x 6″, reduced to a 5 inch circular pipe. This is fitted to a rotating 90°, 5-inch elbow. With the aid of bicycle sprockets and a bicycle chain, this discharge pipe can be rotated by a crank located to the immediate left of the driver; thus, the mist can be directed straight up, straight down, horizontally away from the jeep, or in any intermediate direction.

A "T" joint with a valve is placed just beyond the discharge end of the pump, connected by a length of hose with the old gun-type nozzle for catch-basin or other spraying.

Another "T" joint and valve is located by the intake end of the pump. This is attached to another length of hose, which can be put into a ditch or any other convenient body of water and used to suck up water for refilling the insecticide tank. The intake end of the refilling hose is inclosed with a fine screen to eliminate debris from the tank.

Two of these rigs were built and mounted on jeeps last fall and have been in almost continuous use. No trouble has been encountered; on the contrary, the results have been far better than during the past years of marsh spraying. The opera-

FIG. 1. Side and rear views of jeep-mounted mist blower.

tion is easy on the driver, and the coverage of ditches or open water is far superior to that obtained in other types of spraying.

If the jeep is close to a ditch and the blower discharge is approximately 7 feet from the water, the milky colored insecticide can be seen to penetrate the water to a depth of about 5 or 6 inches due to the high wind velocity.

A marshy field was pre-treated last November with this mist blower. Only one part of the field was treated (about 30 acres). In past years the whole field has produced mosquitoes yearly. This year, in January, no mosquitoes were found in the treated portion while the untreated portion produced *Aedes squamiger* larvae over its entire area (about 40 acres).

Under ideal conditions a 99 per cent kill has been obtained—a distance of 90 feet in open marsh land with one pass of 1¼ per cent DDD against third and fourth instar *Aedes dorsalis*.

THE L–20 AS A VEHICLE FOR AERIAL DISSEMINATION OF INSECTICIDE BY THE U. S. AIR FORCE

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A review of the history of aerial dissemination of insecticides in the Air Force shows a progression of developments in spraying equipment and a succession of operational aircraft modified to function as effective vehicles.

Installation of spray kits on aircraft adds to their gross weight, shifts the center of gravity, and usually leaves the airplane too cluttered for other uses. In addition, those parts of the kit which of necessity must either protrude from within the airplane or be mounted outside the fuselage interrupt the flow of air around the airplane. This in turn affects the control of the aircraft. Spray kits are continually being developed, however, for those cases where control of insects affecting the health or morale of personnel cannot be achieved with ground control methods or equipment. The researches of the Air Force in the development of kits for the dissemination of both liquid sprays and impregnated granules from the L-20 or "Beaver" are presented below.

Experience in Korea during the summer of 1951 demonstrated the applicability of employing both large, twin-engine aircraft and liaison-type airplanes to provide coverage of the varied ecological habitats of disease-transmitting mosquito populations present in enormous geographical areas. First the L-5 and later the T-6 were modified through the addition of various disseminating kits to spray front line installations and other areas not readily accessible to the larger C-46 aircraft.

In 1951 the Air Force placed an order with DeHavilland Aircraft of Canada, Limited, for delivery of its newly designed "Beaver." This aircraft has become subsequently labelled the L-20 by the Armed Services and has been accepted by the Air Force as the light airplane most desirable for aerial dissemination work.

In 1953 the principle of dual coverage learned in Korea was incorporated into the operations of the USAF Special Aerial Spray Unit based at Langley Air Force Base, Virginia. Heretofore all spraying accomplished by this unit, whose mission

was the dissemination of insecticides over all Army and Air Force installations within the continental limits of the United States, was accomplished by means of C-47 ("Skytrain" or "Dakota") aircraft. The L-20 is currently being used in conjunction with the C-47's to cover those areas too small to warrant spraying by the larger aircraft.

The Air Force has developed three separate insecticide dissemination kits for the L-20 during the past two years for use in addition to a patented kit which was procured along with one of the airplanes. Two of these kits, including the patented one, have been discarded and the Air Force is now using a boom-spray system for liquid sprays and a venturi kit for dissemination of impregnated granules.

In May 1953 two "Beavers" which had been assigned to Alexandria Air Force Base in Louisiana and modified for aerial dissemination there, were flown to Langley Air Force Base, Virginia, and attached to the Special Aerial Spray Flight.

These two aircraft were equipped with spray kits consisting of internally-installed tanks and a cylindrical venturi suspended 6 inches beneath the belly of the airplane.

The insecticide was borne in a pair of 55-gallon fuel drums installed horizontally and crosswise on the cabin floor. The drums were connected at the forward ends by a single 2-inch feed pipe which carried the liquid aft to a 2-inch manual shut-off gate-valve located behind the drums and just above the camera hatch in the belly of the fuselage. At this point the pipe was fitted with an elbow and a subsequent length which projected vertically through the camera hatch and terminated in a threaded tip to which a union was attached.

The venturi, which consisted of a 5-foot long tapered aluminum cylinder with a 6-inch diameter air-intake orifice, a barrel, and a flattened terminal funnel, was attached to the aircraft through the vertical feed pipe and a series of braces. The braces included a pair of lateral metal flanges riveted to the camera door access plate and four metal straps extending from the belly of the airplane to the venturi.

The intake orifice withdrew to a 4-inch throat and then opened abruptly to the barrel within a distance of 6 inches. The barrel was 2½ feet long, cylindrical, and was 8 inches in diameter. The terminal funnel was 2 feet long, flattened dorsoventrally, and tapered to an 18-inch wide dispersion slot with a 2-inch vertical orifice. This funnel was strengthened with two aluminum baffles located inside and riveted to both the dorsal and ventral surfaces.

A threaded length of 2-inch pipe, which projected vertically from the top of the venturi through a hole located 15 inches behind the tip of the intake orifice, screwed into the feed pipe from the airplane. Inside the venturi, the pipe was fitted with an elbow and an additional 4-inch length which allowed the insecticide to flow aft horizontally and pour into the accelerated air stream.

Flow of the insecticide was by means of gravity and the rate was manually-controlled by a crew-member who sat behind the insecticide drums and operated the rotary shut-off valve upon hand signals given by the pilot. The effective swath of this apparatus was approximately 75 feet. The rate of flow was estimated on the ground after landing; the droplet sizes were variable and uncontrollable.

Operationally, the kit was unsatisfactory because there were no provisions for quick release of the insecticide and no safety precautions for the crew-member who was forced to ride behind the insecticide drums.

In June of 1953 a third L-20 was assigned to the Special Spray Flight. This airplane was equipped with a patented rotary brush liquid spray system which consisted of an internal insecticide tank whose ends formed a portion of either side of the fuselage, two feed booms, and a pair of propellor-driven wire disseminating brushes mounted beneath the wings.

The drum-like 250-gallon capacity tank

was mounted on a rack which was bolted to the cabin floor. The tank was undivided, contained no baffles, and filler necks were located at the top of either end.

The insecticide flowed by means of gravity through an orifice located in the bottom center of the tank. An 8-inch pipe which conveyed the liquid aft and then vertically through the camera well, terminated beneath and outside the camera hatch in a dome. Two manually-operated 4-inch emergency dump valves were built in to either side of the dome. The pilot actuated these valves by an emergency handle mounted on his control panel.

A 3-inch pipe which was screwed into the dome and lay along the centerline of the belly of the airplane, carried the insecticide forward to a point just aft of the fixed landing gear. A T fitting attached to the pipe at this point by means of disconnect hose fittings diverted the liquid laterally into a pair of 2-inch feed pipes which projected horizontally on either side to the insecticide dispenser. A bracket at the T fitting anchored both the central as well as the lateral feed pipes to the belly of the aircraft.

The insecticide dispensers consisted of housings to which supports were attached and through which the insecticide flowed, and a set of propeller-driven wire disseminating brushes. They were located on a line behind and above the landing gear and about 7½ feet out from the T fitting on each side. Each housing was supported by a vertical streamlined pipe bolted to the lower surface of the wing and drag was counteracted by a sway brace which extended from a point at the bottom and aft of the pilot's door to the vertical support pipe.

A wind-driven, wood, paddle-bladed propeller of approximately 15-inch diameter was fixed to the forward end of a straight shaft which passed through the housing. Wire brushes of either 8- or 10-inch diameter were locked to the aft end of the shaft. The brushes were removable and could be lined up in varying combinations.

The insecticide flowed from the housing to the brushes by means of an opening bored in the aft section of the shaft. Rubber seals prevented the insecticide from dripping from either end of the housing.

Flow of insecticide throughout the system depended upon gravity. The only valves other than the emergency dump valves mounted on the pot were a pair of shut-off valves located on the outer tips of the horizontal feed pipes. These valves regulated the flow into the propellor housing and were actuated manually by a single operating rod mounted in front and parallel with the horizontal feed pipes. This bar was actuated through a series of linkages and a lever located on the pilot's instrument panel.

The effective swath of this kit was 120 feet and the droplet size was comparatively consistent. The micron range of the droplets varied with the brushes used: the average droplet size varying directly with the gauge of the brush wire.

The rotary brush kit was operationally efficient but was not considered practicable for military use. The rigging was too flimsy; the empennage and the fuselage had to be washed down after each application because the insecticide was blown back over it; the linkage system was too complex for field use; difficulty was incurred in maintaining a stock of rotary brush parts; and the shut-off valves did not function properly. The rubber seals inside these valves expanded due to the action of the insecticide. This expansion resulted in their impeding the movement of the metal discs and being sheared off when the valves were forced closed.

Due to the inefficiency of the venturi kit and the difficulty of maintaining rotary brush parts, these original spray systems were replaced with boom spray kits developed along the principle of the equipment used on the C-47.

At first the kit consisted of three 55-gallon drums standing upright in the cabin and anchored to the floor by means of cables. Two of the drums were set

ahead of the third and the three were interconnected by a network of 1¼-inch (inside diameter) pipe. One pipe from either side carried the insecticide aft to a pair of electrically driven B-26 fuel-boost pumps which maintained a pressure of 20 PSI. These pumps were installed in the camera well aft of the rearmost drum. Manual rotary shut-off valves were mounted in each line and just ahead of the boost pumps so that the flow of the insecticide could be regulated from within the airplane while it was in flight.

The insecticide which flowed into the fuel boost pumps was routed under pressure to the two wing booms through a pair of 1¼-inch aluminum tubes. These tubes passed out through the camera hatch then forward along the underside of the fuselage to the two main wing struts. They were anchored to these struts at various points as they passed up and along the trailing edges to the dispersal booms.

The dispersal booms were constructed of 15-foot lengths of 1⅛-inch nominal diameter steel aircraft tubing and were supported by three A frame struts bolted to the lower surface of either wing. Ten spray nozzles were fitted on either side.

The fuel boost pumps were wired through a circuit breaker to a toggle switch on the pilot's control wheel. A master switch on the control panel turned on the power; the switch on the wheel actuated the pumps. A system of three panel lights informed the pilot that (1) the power switch was on; (2) there was either little (3 PSI) or no pressure in the system; (3) pressure was up.

The effective swath of this kit was 140 feet. The system was considered quite efficient except for one thing: the pumps which maintained 20 PSI did not have capacity for increased flow. The atomization rate dropped in proportion to decreases in pressure and it was found that fourteen nozzles put out almost as much insecticide as the full twenty and produced a finer range of atomization.

In 1954 this kit was modified by replacement of the three 55-gallon drums with a rectangular stainless steel baffled tank with a capacity of 175 gallons. In addition a vertical stand pipe which vented the tank to the atmosphere, an insecticide volume gauge, and a filler opening located inside the airplane were added.

This new tank was mounted forward of the camera hatch and was held in place by two strips of T bar aluminum which passed over the top of the tank and were bolted to vertical threaded ¼-inch steel rods which screwed into tie-down ring holes in the floor.

A 6-inch feed pipe which was welded into the lower center of the aft side of the tank emptied the insecticide vertically through the camera well to an emergency dump. A flat, spring-loaded bottom plate which was hinged to the end of this pipe was the emergency dump valve. During normal flight and spray operations this plate remained locked in the closed position with the release valve cocked and ready for instantaneous release. The release valve was actuated manually by a cable which was routed from the locking arm or trigger, up through the fuselage and into the pilot's compartment.

The dump orifice was 6 inches in diameter and a full load of insecticide (175 gallons) could be discharged in ten seconds. The pipe, which barely projected from the belly of the airplane, passed through a 20-inch plate which fitted into the camera hatch. This plate provided additional support to the system.

No change was made in either the booster pumps, feed tubes, spray booms, or the electrical wiring. The two rotary shut-off valves were eliminated with the drum linkage system. The two fuel booster pumps were retained in the camera well and drew the insecticide directly out of the 6-inch dump valve feed pipe through siphon ports.

Recognition in 1954 of the applicability of impregnated granules as a mosquito control measure instigated development of

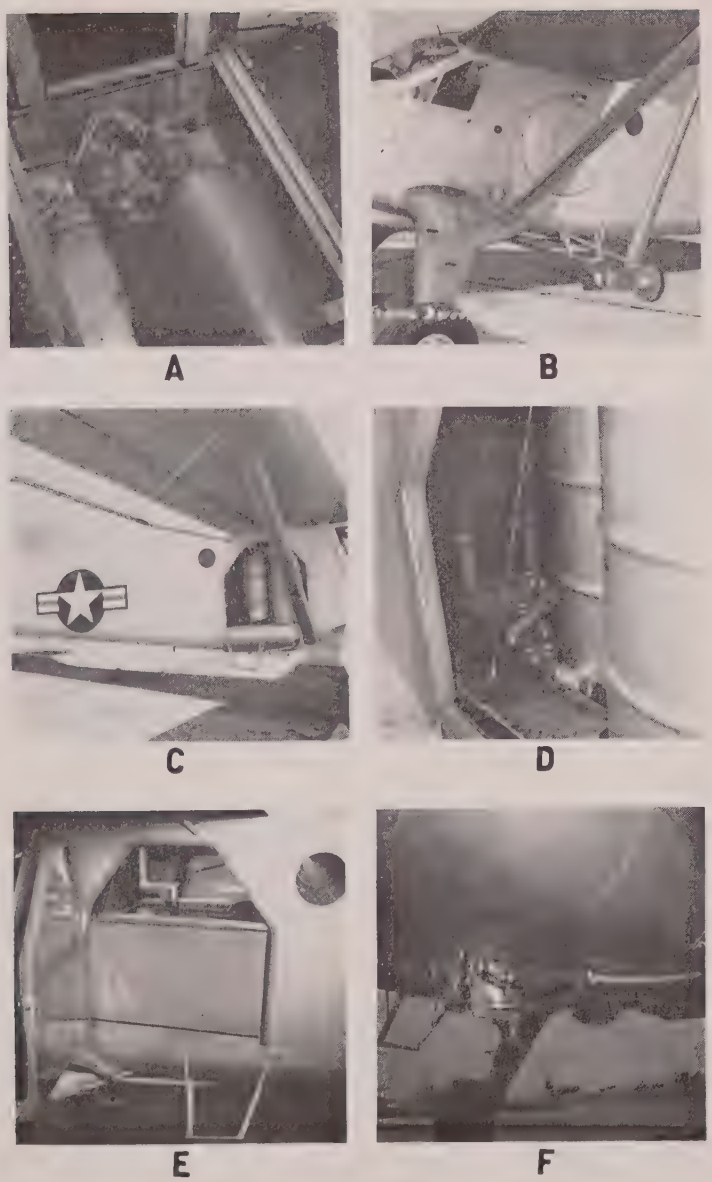

FIG. 1. A—Spray pressure-boost system mounted in the camera well; B—Side view of L-20 with rotary brush liquid spray kit installed; C—View showing fuel drum installation and spray boom with connecting hose; D—View of plane interior showing drum linkage and manual shut-off valve; E—View of internally-mounted 175-gallon insecticide tank with dorsal vent; F—Emergency dump valve in closed position.

hoppers for aircraft so that these materials could be disseminated from the air. Recognizing its extensive requirement for use of this new medium, the Air Force developed a hopper and a venturi box for the dissemination of granules over Air Force installations with the L-20.

An aluminum hopper of 1,000-pound granule capacity, designed to conform to the shape and size of the cabin door and the inside width of the cabin was constructed. This box-like carrier was placed inside the cabin, then tilted aft and supported in that position by means of a frame into which it was bolted.

The frame, built of 2-inch angle aluminum, was constructed so as to elevate the hopper 14 inches in the front and 4 inches off the floor in the rear. The vertical flange of the aluminum bar welded on the back of the frame was turned down so as not to close off the flow slot.

Loading of the hopper was accomplished through a hatch located on the upper surface. The granules were poured through this opening by means of a feeder suspended above the airplane. The feeder consisted of a 55-gallon drum with the bottom cut out and replaced with a large funnel which channeled the pellets into a rubber loading hose.

The granules flowed out of the hopper by means of gravity through a 3-inch slot which extended the width of the hopper and was located along its base.

A feed chute, bolted to the top and sides of the flow slot, directed the flow of the pellets aft and outward through the camera well. The lower edge of this chute slid under the tank so as not to impede the flow of the granules. The feed chute was 3 inches deep and 44 inches wide at its mouth. It tapered to a width of 16 inches over the first 10 inches, then projected aft for another foot at which point it dropped vertically through the camera hatch. The dimensions from the point of taper to where the feed chute joined the venturi box outside the airplane were 3 x 16 inches.

The venturi box was suspended 6 inches beneath the fuselage. It was 6 inches deep, 24 inches wide and 31½ inches long. The venturi consisted of a 3-inch rise or camber in the forward half of the box. The top of the venturi box fitted over the end of the rectangular feed chute and was bolted to it. In addition, it was supported by four braces attached to the fuselage of the airplane.

The rate of drop of the granules was controlled by a sliding-slotted cut-off valve located between the top of the venturi box and the end of the feed chute. This valve was actuated by an arm hooked onto an electric jack screw. A pair of adjustable micro-switches were built into the jack screw. One of these switches was set for open position and the other for closed. The size of the opening required to produce the effective rates of flow was pre-set on the ground by adjusting the positions of the micro-switches. The jack screw was actuated by a switch on the pilot's control panel.

This original kit has already been modified slightly, and more changes are pending.

The actual dispensing mechanism was found to be unsatisfactory during the first operational missions flown by this airplane at Robins Air Force Base, Georgia. The slot in the sliding slotted shut-off valve was widened from ½ to 1 inch to provide increased rate of drop of pellets into the throat of the venturi. In addition to this, the actuating arm on the electric jack screw was eliminated by hooking the jack screw itself to the center-aft section of the sliding-slotted valve.

A formal inspection to determine the structural soundness and aerodynamic suitability of the granule dispensing kit is being conducted at Wright Air Development Center in Ohio. One of their recommendations has been the development of a liquid-tight tank so that the airplane can be used to disseminate either liquid sprays or impregnated granules. Removable spray booms could be alternated with the pellet venturi, and the latter would be replaced by an emergency dump valve.

Other proposed modifications include:

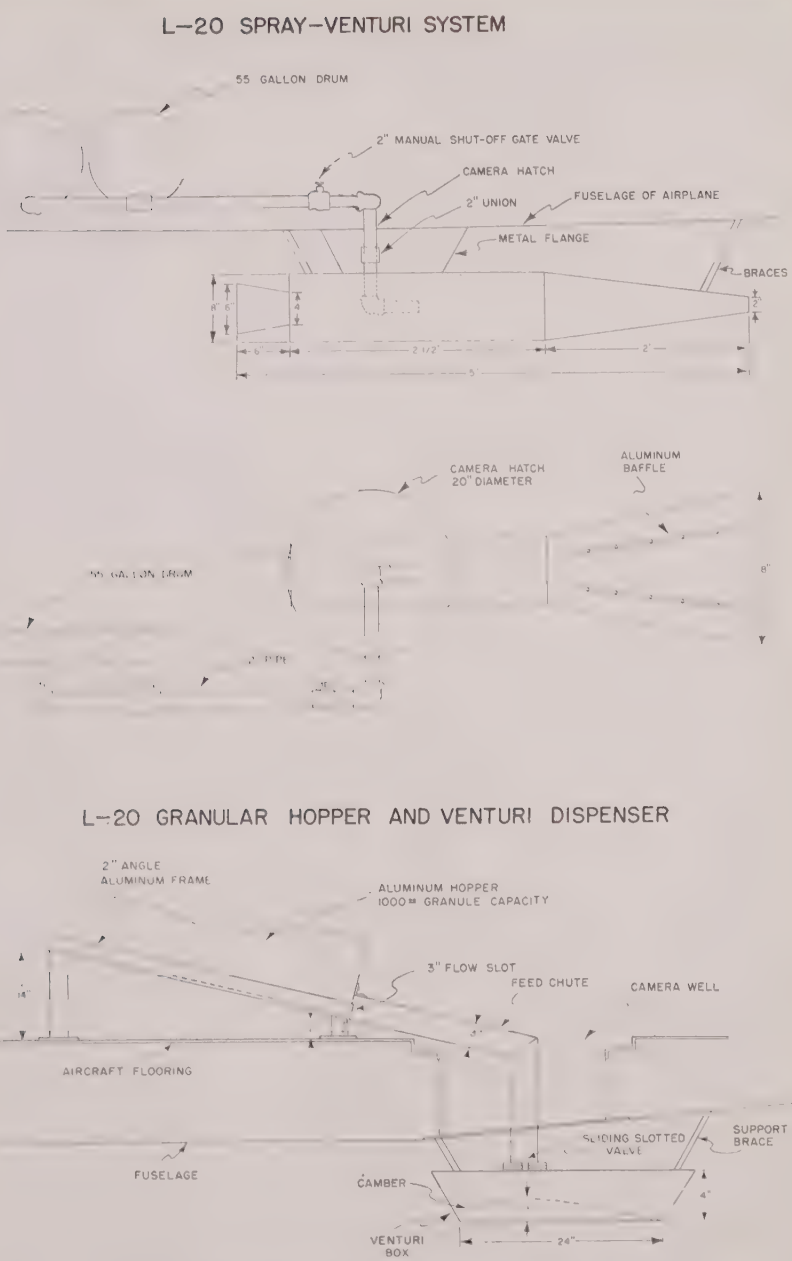

FIG. 2. Construction details of L-20 insecticide dispensing apparatus.

(1) removal of the aft cabin doors and construction of a tank whose ends will form the sides of the fuselage; (2) installation of a pitched bottom inside the tank which will provide for the flow of the granules and eliminate the requirement for the supporting frame; (3) installation of an indicator to show flow of the pellets. This might be a weight gauge mounted in or under the tank to show change in the total weight or an off-pressure switch mounted on the venturi which would indicate flow of pellets through the latter; (4) addition of a dust pan type spreader to the rear of the venturi box which would widen the ejection port from 24 to 50 inches and depress the present slot from 6 to 2 inches. The purpose of this spreader would be to widen the current effective swath of 35 feet to at least 50 feet.

Because of its high degree of maneuverability, its ruggedness, and load capacity, the L-20 "Beaver" was selected as a possible vehicle for the USAF Special Aerial Spray Flight. Development of professional insecticide dissemination kits specifically engineered for installation in this airplane increased its applicability.

Operational experience in the Air Force during the past two years has shown that addition of the L-20 has expanded substantially the operational scope of the Spray Flight and enhanced the value of this unit by insuring its ability to cover all aspects of the terrain.

As a result of effective utilization of the airplane and continuing improvement through modifications of the respective spray kits, the L-20 "Beaver" has come to be a most satisfactory supplementary dissemination vehicle and has indirectly become an integral unit in the over-all Air Force program for the aerial dissemination of insecticides.

THE ATTRACTIVENESS OF HUMAN SWEAT TO MOSQUITOES AND THE ROLE OF CARBON DIOXIDE

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Although human sweat has long been suspected of being attractive to mosquitoes, early investigations (Howlett, 1910; Crumb, 1922; Rudolfs, 1922) found little to substantiate this belief. However, more recent experiments (DeLong *et al.*, 1949; Willis, 1947; Parker, 1948) have yielded evidence that sweat can be attractive. Furthermore, field experiments with robots (Brown, 1951) showed that sweat-soaked clothing was almost twice as attractive to Canadian *Aedes* mosquitoes as equally moist clean clothing. Moreover, laboratory experiments with an olfactometer (Brown, Sarkaria and Thompson, 1951) showed that the vapour from an aqueous solution of human sebaceous sweat would bring approximately 40 per cent more females of *A. aegypti* to the experimental port than to the central port which carried only water vapour.

Human sweat is comparable to a weak solution of sodium chloride in water and contains, at least in traces, practically all of the non-colloidal constituents of blood plasma. It is produced in large part by the sudoriferous glands, which are simple tubular structures distributed over the entire body surface, being most abundant on the palms of the hands, the soles of the feet, and the forehead (Kuno, 1934).

This sudor is admixed in most regions with sebum, which is produced by the sebaceous glands; these are complex and alveolar in structure, opening most frequently into hair follicles. Sebaceous glands are most abundant in the armpits and inguinal areas, about the scalp and face and around body apertures, and are also distributed all over the body surface with the exception of the palms of the hands and the soles of the feet. Sebum is an oily material containing lower fatty acids, higher primary alcohol esters and cholesterol, in addition to albumins and inorganic salts. In the experiments reported in this paper, sweat from the armpits and sweat from the forehead were tested separately to determine whether they evoked the same response in mosquitoes. Both these sources of sweat are a mixture of sudor and sebum, armpit sweat containing more sebum and less sudor than forehead sweat. It was found impossible to obtain pure sudor from the palms of the hands in sufficient quantity for experiment.

MATERIAL AND METHODS. The stock of *Aedes aegypti* (L.) was maintained in a greenhouse at temperatures of 68–85° F. and relative humidity of 45–70 per cent. The larvae were reared in enamel pans on a diet of 1 part dried yeast and 2 parts dog biscuits. The adults were confined in a large, screened cage 10 ft. long by 4½ ft. wide by 8 ft. high, the population being maintained at 500–1500 females. They were fed on raisins and on blood secured from a live rabbit placed in the cage once or twice a week.

All experiments were performed in the large cage. The olfactometer employed has been fully described elsewhere (Brown, Sarkaria and Thompson, 1951) and consists essentially of two ports 3.5 ins. in diameter, suspended 16 ins. apart and each emitting an air stream at 5 litres per minute. The air leading to the ports was bubbled through gas-washing bottles containing the liquid to be tested.

Observers at each port counted the number of approaches made by mosquitoes within 0.5 in. of its surface. When either observer had counted 50 approaches, the count was stopped and both figures were recorded. A set of 8 such counts constituted a test. Position error between the two ports and counting error between the two observers, neither of which ever exceeded 10 per cent, were compensated by appropriate interchanges of ports and observers (Brown, Sarkaria and Thompson, 1951).

ATTRACTIVENESS OF ARMPIT SWEAT. The vapour from armpit sweat at various concentrations was compared with moist air for its attractiveness to the mosquitoes. The sweat was obtained by placing filter papers under the armpits of several young Caucasian males who had taken strenuous exercise. The samples thus obtained from a group of subjects were then placed in a known volume of distilled water. The average sample of sweat on a filter paper weighing 186 mg., and the aliquots of water chosen per filter paper being 6, 60 and 600 cc., the aqueous concentrations thus obtained were 31, 3.1 and 0.31 mg. per cc. These solutions were refrigerated until testing, at which time they were added to one of the gas-washing bottles leading to the olfactometer, distilled water being used in the other bottle as a control. Tests with the 3 concentrations were performed under environmental conditions of 65–85 per cent R.H. and 74–92° F. The ratio between the experimental figures and the control figures has been termed the Attractiveness Ratio.

The tests showed that the sweat vapour attracted no less, and often considerably more, mosquitoes than did the moist air stream. The variance involved in the 8 counts of each test was statistically analyzed, and the value of Student's t was obtained to determine the probability of the figures indicating a significant difference between the presence and absence of the sweat. At the highest concentration, 1 of the 3 tests showed statistical significance at the 5 per cent level; at the intermediate concentration, 2 of the 4 tests were significant; and at the lowest concentrate, none of the tests showed that a significant difference existed. When

the data for all the tests are considered together at each concentration, a significant difference at the 5 per cent level is to be found at 31 mg. per cc. and at 3.1 mg. per cc., but not at 0.31 mg. per cc. Thus it may be concluded that at adequate concentrations armpit sweat vapour is significantly attractive, drawing on the average (in this experiment) 25 per cent more adult *Aedes aegypti* than water vapour alone. The variance is such that certain tests may show no difference in the numbers attracted, while others may show 50 per cent more mosquitoes approaching the source of the sweat.

A second experiment was carried out in which cloth-covered spheres were employed instead of the olfactometer. A single layer of black broadcloth was wrapped around black plastic billiard balls mounted on vertical rods and held 16 ins. apart. Tests of 8 counts each were conducted in which a cloth-covered sphere soaked in armpit sweat was compared with one soaked in distilled water. The counting procedure was identical to that used in the olfactometer experiments, except that the mosquitoes were required to touch the surface of the cloth in order to be counted. A series of 3 tests were carried out at each of the concentrations previously described. The results gave average attractiveness ratios of 1.01, 1.02 and 0.93 for sweat concentrations of 31, 3.1 and 0.3 mg./cc. respectively. It may be therefore concluded, without statistical analysis, that human armpit sweat presented on clothing exerts no attraction for *Aedes aegypti* under these laboratory conditions.

ATTRACTIVENESS OF FOREHEAD SWEAT. A series of olfactometer experiments was performed with sweat collected from the foreheads of white Caucasian males. The aqueous elutions from filter papers were diluted to give concentrations of 29, 2.9 and 0.3 mg. of sweat per cc. Three tests of 8 counts each were carried out for each concentration of sweat, employing moist air as the control, at 43–63 per cent R.H. and 82–96° F.

It appears from the results that the sweat vapour at all three concentrations was slightly less attractive than moist air. Statistical analysis however, shows the t values (for 23 degrees of freedom) to be only 1.21, 0.88 and 0.32 for 29, 2.9 and 0.3 mg./cc. respectively and thus insufficient for significance. It may therefore be concluded that the difference in attractiveness between forehead sweat and moist air is negligible.

CARBON DIOXIDE IN SWEAT. A series of three experiments were performed to investigate the possibility of CO_2 being responsible for the attractiveness shown by armpit sweat. Here the olfactometer was employed with the usual procedure, at 40–65 per cent R.H. and 77–94° F., the materials being added to the gas-washing bottles. In the first experiment, a solution of armpit sweat at 3.1 mg. per cc. was freed of CO_2 by precipitating it as barium carbonate by the addition of 10 per cent $BaCl_2$ solution in the ratio of 1 cc. per 1 gm. of sweat; this CO_2-free sweat solution was compared with normal sweat solution at the same concentration. In the second experiment, a similar sweat solution was saturated with CO_2 vapour added through a bubbler; it was then compared with the normal sweat solution. In the third experiment a solution of CO_2 in water was prepared, having the same concentration as that which occurs in armpit sweat. This solution was made by adding 382 mg. of $NaHCO_3$ and 61 cc. (at N.T.P.) of CO_2 to 100 cc. of distilled water. The solution therefore contained 0.20 per cent bound and 0.11 per cent free CO_2, which were the average figures obtained when fresh armpit sweat was analyzed for its content of CO_2 (Am. Publ. Health Assoc., 1946). This solution was then tested against distilled water, in order that its vapour might be compared with moist air.

The average attractiveness ratios obtained in the first two experiments indicate that there is no difference in either case between the experimental and the control sweat solutions. The attractiveness ratio of 0.87 in the third experiment might have been taken to indicate that the experimental solution was slightly less at-

tractive than the control, but statistical analysis indicates that the difference is due to the high variance and thus is not significant ($t = 0.74$). It may therefore be concluded that CO_2 neither increases nor decreases the attractiveness of armpit sweat or aqueous solutions.

Carbon Dioxide in Clothing. In field experiments with robots, Brown (1951) had found sweat-soaked clothing to be considerably attractive to species of Canadian *Aedes* but clothing soaked in water saturated with CO_2 to be no more attractive than clothing soaked in adulterated water. It was decided to repeat the latter experiment under laboratory conditions with *Aedes aegypti,* utilizing the cloth-covered spheres. A series of 5 tests, each with 8 counts, was performed with the CO_2-saturated water as the test solution and distilled water as the control, at 53–74 per cent R.H. and 77–84° F.

The results, not tabulated here, indicated that the black broadcloth soaked in CO_2-saturated water gained attractiveness ratios between 1.12 and 1.38, being on the average 24 per cent more attractive than the cloth soaked in distilled water. Five similar tests were performed using white cheesecloth as the covering; here the average attractiveness ratio was 1.33 with the values ranging between 0.93 and 1.98. Statistical analysis revealed that the t value, for all counts taken with the black broadcloth was 4.38, and with the white cheesecloth 4.44, both of which indicate highly significant differences at the 0.1 per cent level. It may therefore be concluded that the addition of CO_2 to wet clothing significantly increases its attractiveness to *Aedes aegypti* under laboratory conditions.

Volatile Acids and Bases. Of the fatty acids which might be expected to occur in sebaceous sweat, oleic, valeric and lactic acid have been found unattractive to *Aedes sollicitans* (Rudolfs, 1922). Lactic and propionic acid have proved slightly attractive, and by comparison formic and acetic acid slightly repellent, to *A. aegypti* (DeLong *et al.,* 1949). Acetic and lactic acids were found to be indifferent at low concentrations and comparatively repellent at high (Brown, Sarkaria and Thompson, 1951) when tested in the olfactometer. Since the addition of CO_2 to water-soaked cloth-covered spheres had proved attractive (see above), the effect of adding 0.1 per cent acetic acid to these surfaces was investigated. Four tests of 8 counts each were performed at 70–85 per cent R.H. and 78–80° F. In every test the surface with acetic acid was less attractive, the attractiveness ratios falling between 0.61 and 0.70.

In a second series of 8 tests with 8 counts each, performed with the olfactometer, the volatile acids which were present in a solution of armpit sweat (3.1 mg. per cc.) at the normal pH of 6.5 were first released from ester linkages by acidification to a pH of 1.9 with dilute H_2SO_4. When air was then bubbled through this solution and the vapour emitted through the olfactometer port, the attractiveness ratios as compared with the vapour from a similar but untreated sweat solution were between 0.64 and 0.97, with a mean of 0.82. Statistical analysis of all 64 paired counts revealed a t value of 2.90, which indicates a significant difference at the 1 per cent level. The individual test with the highest attractiveness ratio showed its difference to be significant at the 5 per cent level.

Volatile bases such as ammonia and trimethylamine have been found to be unattractive to *A. aegypti* (Brown, Sarkaria and Thompson, 1951). In an attempt to discover if any of the volatile bases released on addition of alkali to sweat were attractive, a solution of armpit sweat at 3.1 mg. per cc. was made alkaline with Na_2CO_3 to a pH of 9.4. When air was bubbled through this solution and simultaneously through a similar but untreated solution, and the vapours compared in the olfactometer, the attractiveness ratios obtained in 3 tests were 0.97, 1.02 and 1.11, indicating that the treatment did not affect the attractiveness.

It may therefore be concluded that the

attractiveness shown by armpit sweat is decreased by the release of volatile acids present in the sebaceous portion and normally held by esterification, whereas the release of any volatile bases present has essentially no effect on the attractiveness.

CONCLUSIONS. Sweat from the armpits of Caucasian males has proved significantly attractive to adult females of *Aedes aegypti* when tested in the olfactometer at sufficient concentration. Sweat collected from the forehead was not attractive in the olfactometer. The attractiveness of moist clothing was not increased by the addition of armpit sweat.

It is unlikely that carbon dioxide is responsible for the attractiveness of human sweat in the olfactometer, since its addition to or removal from armpit sweat did not alter its attractiveness, nor did the addition of CO_2 at the level found in sweat increase the attractiveness of distilled water. However, the addition of CO_2 to water-soaked cloth significantly increased its attractiveness under laboratory conditions.

The volatile acids freed from sweat by acidification have a repellent effect on it, whereas the bases freed by rendering it alkaline do not alter its attractiveness.

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CULEX THRIAMBUS DYAR FROM NEW MEXICO. Three larvae of *Culex thriambus* Dyar were collected from residual pools in an irrigation canal at Virden, Hidalgo County, New Mexico, September 17, 1953. The larvae were found in association with *Culex tarsalis, Anopheles franciscanus,* and *Psorophora signipennis.* This collection was taken in connection with mosquito studies conducted by the Logan Field Station Section (formerly Water Projects Section), CDC, U. S. Public Health Service, and constitutes a new mosquito record for New Mexico.—Charles S. Richards, Comm. Dis. Center, Pub. Hlth. Service, U. S. Dept. of Health, Education and Welfare, Logan, Utah.

STUDIES ON INSECTICIDAL FOG GENERATION FOR MILITARY USE

I. *Military Research on a Non-Thermal Aerosol Fog Generator*

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For several reasons, fog generation by the currently-used thermal means does not completely meet all military requirements. Thermal generation, however well controlled, entails the presumptive threat of creating a fire hazard or of being hazardous to personnel and the effect of the heat on certain insecticides and other agents is still not a matter of universal agreement. In tests at the Engineer Research and Development Laboratories we have found closely controlled spectra of particle sizes to be the exception rather than the rule with thermal generation. Where the equipment is capable of giving some control of particle size, it still is too heavy, too cumbersome or too complicated to be entirely acceptable for military operations. On the other hand, none of the alternative purely mechanical means has so far produced true fogs or produced them in a sufficient quantity to be satisfactory.

Military requirements are somewhat more exacting than civilian requirements because military equipment must be operated in rough or unimproved terrain, far from good repair and replacement facilities and often by personnel who are not completely trained or able to take all the care and precautions we might normally desire in the operation of equipment. While eye-appeal is important to military public relations, as it is to commercial, and while many of our situations are no different from those of non-military agencies, we must have the combat zone constantly in mind and must call for features of mobility, ruggedness, simplicity and dependability which would not always appeal to the average user.

With the military needs in mind, therefore, various non-thermal methods were tested and satisfactory modifications of them were attempted. Some of these, which seemed promising mechanically, developed unacceptable characteristics when variations in size, gallons per hour output or particle range were sought. At length it was decided to abandon the approach of remodeling existing equipment as units, and to work on the development of components which, while retaining the character of being compatible with commercial production, should each give the most satisfactory results as an individual mechanism. It was also realized that if each of these components could be an already standard item of manufacture, or so nearly standard that there would be no need for any difficult re-tooling by industry, we should gain both in cost economy and in ease of making replacements.

A commercial nozzle, first developed by Yeomans and commonly used on small equipment which is designed to be used in single rooms, was adapted for use in larger equipment for both indoor and outdoor use. Experimentation and engineering tests have shown that this nozzle can be used at low air pressures as a single unit to give a suitable fog at 5–10 g.p.h.; in multiple arrangement with an air source of larger output but still at low pressure, machines can be composed with increasingly greater capacities. A commercially-available air blower was selected which provided the required air output at low pressures and yet is small enough to leave the completed machine readily mobile and maneuverable. A new engine of very light weight but great power and higher than usual r.p.m., which is just

completing developmental test at the Laboratories is used as the power source.

The oil used in the tests is Texaco #300 burning oil, a standard, almost completely non-volatile, oil having a density similar to Sovacide F, diesel #2, and other common fogging solvents. By supplying an appropriate volume of air at 5 p.s.i., a machine capable of creating a fog of any desired particle range from 10 microns to 40 microns or even larger, according to the quantity of liquid introduced, has been constructed. The spectrum produced is quite narrow, giving a rather symmetrical curve, and being normally within a range of about 20 microns on each side of the median; it can be reproduced whenever the appropriate settings of air volume and liquid are repeated. Insecticide output and particle size are controlled by liquid valve adjustment, air pressure regulation, or both.

So far this machine has been constructed only in the laboratory and difficulties of which we are not aware may well arise when we attempt to translate it into a field mechanism. However, on the basis of our military experience with field equipment and commercial equipment adapted to military field use, we do not anticipate any insurmountable difficulty. The nozzle is simple with no finely-machined orifice to be subject to plugging or erosion, the air source is a rugged, positive-displacement blower, the power source is a simple gasoline engine. Mounted in a ¼ ton trailer pulled by a jeep, the equipment can be carried into almost any terrain. A smaller size of about 10 g.p.h. output, which could be carried by two men or pushed on wheels, is also anticipated.

While this equipment is not capable of being home-made, like the famous Plumber's Nightmare, it is not overly expensive and we hope to develop it into a piece of equipment which will require little manpower to operate and less to keep in repair. Extensive basic research is being continued on the entire subject, concentrating especially on the quality of the fog in terms of particle size control, and in addition, striving for low weight, small size and low cost. Commercial manufacturers, as has happened once or twice before, have also shown an awakened interest in the possibilities of such an arrangement and it may not be long before similar equipment makes its appearance outside military channels.

II. *Solvents for Insecticidal Fog Formulations*

A. W. MORRILL, JR. AND CARL WESLEY, JR.

In connection with the studies on thermal and mechanical fog generation, research was conducted on the properties of various solvents and their suitability for fog formulations. Ten years ago, in some of the earliest investigations made in this country, Latta (4, 5) used an Army screening-fog oil having an S.A.E. rating of 50. Yeomans has also advocated the use of motor oils such as S.A.E. 10 and S.A.E. 50 and more recently stated (9) that about one-fourth of the formulation solvent should be such a non-volatile oil, particularly S.A.E. 50 motor oil, which might be added to mixtures of kerosene, xylene, carbon tetrachloride, cyclohexanone, tetrachlorethylene or other similar more volatile solvents. LaMer, Hochberg, Latta, *et al.*, in 1947 (3), found that oil solutions of this type did not decompose so readily with heat as did pure DDT, while Peterson (6), using fuel oil, S.A.E. 10 and S.A.E. 50 motor oils in 1952, found that a solution "based on fuel oil No. 2 has a much higher output for a droplet spectrum of 15 microns than one based on

S.A.E. 10 oil. . . ." He also found that a 5 per cent DDT formulation, applied by the thermal-generation technique was a satisfactory concentration and that the use of 20 per cent or higher was unnecessary and uneconomical.

Following these leads, operators generally have used diesel oil 5 per cent DDT formulations, with the addition of various proportions of fog oils, S.A.E. 50 motor oil, etc., for non-volatility and of carbon tetrachloride, tetrachlorethylene, xylene, etc. where volatility and small particle diameters are desired. Use of these latter materials has increased during recent years as fog machines have been modified to avoid taking the insecticide through the heating chambers because of the possibility of breaking down the DDT, which is still a moot problem. Operators have also turned to these materials with greater frequency as the use of fog has become more extensive in warehouse operations and less intensive out of doors, so that smaller particles have become more and more desirable.

In these military operations, the base oil has often been the mixture which is issued for use as an airplane spray. This has a base solvent with the character of a mixture of diesel oil No. 2 and heavier motor oils, which contains 20 per cent DDT: thus it is usually diluted with diesel oil No. 2, one part to three, resulting in an oil mixture approximating diesel oil in all major characteristics. Mixtures of the emulsion concentrate, in which the base solvent is xylene, with diesel oil No. 2 and S.A.E. 50 motor oil have also been used extensively in some areas overseas.

None of these mixtures has been entirely satisfactory, their use being a matter of expediency, rather than of considered choice. Laboratory-controlled field tests have shown that particle diameters tend to be distributed over a wide spectrum of sizes while field use has proved also that whenever materials are used which are capable of being readily volatilized into a screening smoke, control operators are under a heavy compulsion to use this smoke for its psychological value rather than to use the more effective particle sizes for their insecticidal worth.

More recently, "gap" oils have received wide attention because it has been claimed that they give a more uniform and narrow spectrum of particle sizes. These "gap" oils are a mixture of dissimilar oils, the fractional boiling points of which lie in ranges which do not overlap; they may be represented by a mixture of diesel oil No. 2 and S.A.E. 50 motor oil. While the results reported by various investigators have not always been entirely consistent, it has been generally agreed in unpublished discussion that these oils do seem to have a somewhat better characteristic than straight diesel oil or the diluted airplane spray. A 30 per cent DDT solution in xylene diluted by 5 parts of diesel oil to one of the original solution, was used by Brown and Mulhern (2) in 1954, and in 1953 Brown and Watson (1) reported using a No. 1 diesel oil, a gap oil and a methylated aromatic, although they did not note any significant differences in the results obtained from them.

While research has continued to be extensive in many kinds of solvent mixtures, as may be seen, diesel oil has continued to be the solvent most commonly used in most commercial and community abatement work as well as in the military practice. In the course of searching for equipment which would be satisfactory when used in places far from repair and replacement supplies, it seemed of primary importance also to find a suitable solvent for use under these military conditions. It is the consensus of those who have suffered from supply problems overseas, that in military use there was a definite likelihood of fog operations having to be conducted in areas where the use of special formulations or solvents would be logistically undesirable. Studies were therefore commenced looking toward the discovery of a suitable solvent composed of those hydrocarbon oils which would be readily available at any motor pool and which therefore would be quickly obtained in

TABLE 1

Break-Up Characteristics of Various Insecticide Oil Formulations

Material	Method of Dispersal	Per cent particles in apparent micron diameter range of								Per cent within 10 microns below MMD	Calculated MMD[2]
		0–10	20	30	40	50	60	80	100[1]	(%)	(/u)
		5.0(5/u)									
Indoor fogging mixture (83% Tetrachlorethylene) (5% S.A.E. 50 Motor Oil)	Mech.[3]	43.0	35.5	15.0	1.5					78.5	11
	Therm.[4]	4.0	25.5	24.0	19.5	11.5	11.5	1.5	2.5	49.5	20
Kerosine[5]	Mech.	31.5	48.5	14.5	5.0	0.5				80.0	11
	Therm.	3.0	22.5	40.5	20.5	7.5	3.5	2.0	0.5	63.0	20
Kerosine (deodor.)	Mech.	15.5	61.0	18.5	5.0					76.5	11
	Therm.	—	—	—	—	—	—	—	—	—	—
No. 300 Burning Oil	Mech.	15.0	38.5	24.5	15.5	5.5	0.5		0.5	53.5	11
	Therm.	1.0	12.0	25.5	35.5	16.0	7.0	3.0		61.0	32
Airplane Spray-Diesel Mix. (75–25)	Mech.	11.5	40.5	29.0	16.5	2.5				51.5	11
	Therm.	—	—	—	—	—	—	—	—	32	32
Diesel Oil #2	Mech.	5.5	42.0	36.5	16.0					78.5	20
	Therm.	1.5	24.5	32.5	24.5	10.0	6.5	0.5		57.0	20
"Gap" Oil	Mech.	7.5	28.5	33.0	24.0	5.0	2.0			61.5	20
	Therm.	1.0	16.5	34.0	28.5	9.0	7.5	2.5	1.0	50.5	20
Diesel #2—S.A.E. 50 (80–20)	Mech.	1.5	29.5	45.0	18.5	5.5				74.5	20
	Therm.	2.5	16.5	16.5	33.5	14.0	12.5	3.5	1.0	50.0	32
Airplane Spray	Mech.	1.5	16.5	52.5	26.5	1.5	1.0	0.5		69.0	20
	Therm.	0.5	12.0	19.0	32.0	17.5	12.5	5.0	1.5	51.0	32

[1] Or over.

[2] Particles captured on magnesium oxide coated slides passed once for 1 sec. exposure at distance of 10 feet from outlet. By comparison with diameters calculated on dri-film coated slides, f at 20/u is .55; at 30/u it is .66 and at 40/u it is .80.

[3] 5 p.s.i. air pressure; 2.5 g.p.h. per nozzle—70° temp. air, liquid & ambient.

[4] Setting at mid-position for "wet" fog.

[5] Spelling preferred by the A.P.I.

quantity by a control unit operating in any theatre of combat operations, as well as in the communications zones to the rear.

The results of a series of fogging operations with the non-thermal generation method, and using various formulations, are shown in Table 1, together with the averages of several series conducted with thermal generators. The results are not strictly comparable because the number of particles which escaped as smoke and did not impinge on the magnesium oxide slides after thermal generation cannot be easily shown. However, considering only those particles which did impinge, it will be seen that the mechanical method is at least equivalent to and in some instances superior to the thermal method in compactness of spectrum and percentage of total particles falling closely below the mass median point.

Parenthetically, it might be noted that nomenclature of petroleum solvents in the insecticide literature shows so wide a diversity of use for the same terms that it appears that some standardization should be attempted. Discussions with leading oil companies and with the American Petroleum Institute have brought out the fact that viscosities and flash points often are either non-differentiating or inapplicable. For instance, fuel oil #2 and diesel oil #2 have similar viscosities, and the flash point of diesel is virtually the same as that of materials commercially known as deodorized kerosines. The two fuel materials are differentiated by cetane ratings but no such rating is usually given for kerosines. However, the American Petroleum Institute (API) gravities are widely recognized and are different for each material, as are the centipoise viscosities. It is suggested that, as a starting point for discussion, the classification in the accompanying table (Table 2) be considered:

The wording "diesel fuel oil" is suggested by all oil companies and the institute to avoid confusion with diesel lubricating oils.

As Yeomans has stated in the previously cited references, it would be most desirable to have formulations consisting of highly volatile solvents with a high capacity to dissolve the insecticide and stabilized by the addition of a heavy and relatively non-volatile motor oil. Nevertheless, such special formulations would be likely to be dependably available only in rear areas, and they are far more expensive than the materials hitherto used. It appears that the best second choice is an oil similar to the mixture of diesel oil No. 2 and motor oil, which may be purchased ready-mixed in the continental United States and formulated under emergency conditions overseas from commonly-used materials.

TABLE 2.—Suggested classification of fog oils

Material	API Gravities	Specific Gravities	Centipoise Viscosities
Kerosine (stove oil, diesel fuel oil #1)	42.0	.81	1.7
Deodorized Kerosine	40.5	.82	1.7
Diesel Fuel Oil No. 2	38.3	.83	3.8
Fuel Oil No. 2	33.9	.85	3.8
No. 300 Burning Oil	35.0	.87	5.6

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REPORT OF A THREE YEAR LIGHT TRAP SURVEY FOR BITING DIPTERA IN PANAMA

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The purpose of this article is to report on light trap operations conducted by the 25th Medical Detachment (Preventive Medicine Survey), operating from the Surgeon's Office, U. S. Army Caribbean, Fort Clayton, Canal Zone.

Malaria control has been the important mission of this survey unit since its reactivation in Panama. Studies in jungle yellow fever have been next in importance and studies on pests or biting insects the third problem.

On all military installations horse-baited traps have been employed almost exclusively as a means of measuring population densities, thereby giving a constant check on the effectiveness of various control measures being used. Also, larval collections have been made routinely and systematically on and adjacent to all military installations. Horse traps cannot readily be transported to outlying districts and male mosquitoes, which are often needed for taxonomic purposes, very rarely enter such traps. These two factors contribute to the justification for the use of light traps.

This paper deals with light traps, a method of capturing insects which was not used extensively in Panama before the senior author initiated the present reported surveys. The purpose of these surveys was to establish the distribution of insects of medical importance which could be attracted to light. When the surveys were first initiated it was thought that it would be confined to studies on the genus *Anopheles*, the vectors of malaria, but the first surveys were so successful that they were soon expanded to include all biting Diptera, not only in the Canal Zone but also in the interior of Panama.

The present paper is the forerunner of a series of small papers which record the results of the surveys. A great many species taken in these surveys are being described by various workers. It is therefore felt that a short paper which establishes location and dates of surveys may stimulate subsequent workers to expand the survey area and fill in some of the gaps that we were not able to accomplish. In this paper only general remarks are made on the results obtained, since a series of short papers are being prepared to cover the details.

The Republic of Panama lies between Costa Rica and Colombia, at 7°39′ North latitude and between 77°15′ and 83°30′ W. longitude. It has an area of 34,169 square miles ranging in elevation from sea level to over 10,000 feet in the volcan section near Costa Rica. The Canal Zone is a strip of

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land approximately 10 miles wide reaching from the Atlantic to the Pacific Oceans, a distance of approximately 50 miles. The climate is entirely tropical. The wet season lasts from April to December. Rainfall varies from approximately 155 inches to 85 inches a year, the Pacific side getting the lesser amount. Most of the road system extends from near the Costa Rican border to Chepo on the Pacific side, the Trans-Isthmian Highway and a number of lesser highways.

All military installations are in the Canal Zone. There are two maneuver areas in the Republic of Panama, one near Pacora and the other near Rio Hato.

Most of our surveys have been on the existing road system but several surveys have been made in the Darien Province near the Colombian border. This area was reached by boat through the courtesy of the Inter American Geodetic Survey operating out of Patiño Point. One other large series of surveys was conducted by the Gorgas Memorial Laboratory near Almirante, in the Province of Bocas del Toro. This work was done in connection with the yellow fever studies and most of the surveys were conducted at one station in deep tropical rain forest, at an elevation of approximately 600 feet.

Light traps have been operated at 138 different locations, and a total of 454 nights. Very often as many as three generators and six or more light traps would be operating concurrently within a few miles of a given locality. When the unit was up to strength of eleven enlisted men it was possible to station a crew of two men with each generator but as personnel became scarce, it was necessary for two men to operate a battery of generators, driving all night to service the equipment. By such procedure we were able to cover a great many more ecological habitats in a given area. These surveys represent, by far, the most extensive light trap operation ever conducted in any country. Nevertheless, there is a huge area that has not been properly surveyed. Most of the Darien ranging from sea level to over 7,000 feet has not been touched entomologically. The only area that has been properly surveyed is the Mojinga Swamp, an area of approximately 25 square miles in the Fort Sherman Reservation on the Atlantic side. This area has been very rich in biting Diptera. The Volcan has a most interesting fauna due to the variation in elevation. It has not been properly surveyed. A great deal more work should be done in the Los Santos and Herrera Provinces. Our surveys in the Volcan Area extend from near sea level at David to over 6,000 feet at Cerro Punta.

Many of the islands on both the Atlantic and Pacific sides are unsurveyed and the entire Atlantic Coast from Almirante, near the Costa Rican border to the Colombian border is untouched by light trap surveys. Many of the larger rivers offer unlimited material for study if these areas could only be explored. Another weakness in our work is the lack of surveys at different seasons of the year. In the tropics one finds peak seasons of populations just as in the north but not so pronounced. Certain species may be common one month and almost entirely absent the remainder of the year.

EQUIPMENT: The standard New Jersey type light trap has been employed extensively throughout our surveys. The power for these traps was generated by portable gasoline driven generators. In addition to these traps the Shannon trap has been operated in some areas. This trap is a tent-like affair made of cheese cloth or mosquito netting. This tent is hung up from the four corners by tying cord or rope to a limb or tree at a height that will permit approximately two feet clearance at the bottom of the tent. A light is hung inside and near the top of the tent. This light attracts the insects to the tent and once inside they are captured from the walls and sides of the tent with a suction tube or other appropriate equipment. In most instances reported here a gasoline lantern was used but an electric light of 100 to 200 watts gave about the same results.

METHODS: In all our surveys at least one or more traps have been used at each location. In many instances four traps have been operated from one generator and at the same time a Shannon trap has been operated nearby. In addition to this, various colored bulbs have been used ranging up to 100 watts. Also, a series of tests have been run comparing the effect of different colored paint on the top of the traps. These results will be published in subsequent papers. Specimens were brought into the laboratory, identified and preserved.

It might be well to mention here that collecting in the tropics was a constant battle. While in the field, humidity and dampness, which accelerates growth of mold is probably one of the worst hazards. Ants will also steal specimens from under the microscope while one is studying the specimens unless ant protection is provided. Psocids will completely ruin Diptera in a very short time.

The writers poured melted paradichlorobenzene in the bottom of powder boxes and layered the specimens in padded cotton cut to fit the boxes. Specimens were placed in cabinets equipped with heat units as soon as they were brought to the laboratory. They were separated as fast as possible but the laboratory was usually a few months behind.

All specimens of medical importance were picked out and the residue which we labeled "Trash" was repacked in powder boxes and sent to Washington where specialists of the Bureau of Entomology and Plant Quarantine picked out the things that were useful to the national collection. This often provided many species new to the collection and some that were new to science.

Specimens that we consider of medical importance were divided as follows: All mosquitoes were kept for taxonomic studies by the present authors, with Dr. Pedro Galindo of the Gorgas Memorial Laboratory directing these studies. *Phlebotomus* were turned over to Drs. Alexander Graham Bell Fairchild and Marshall Hertig. Tabanids were sent to Dr. Fairchild. After tentative identification, *Culicoides* were transmitted to Dr. Willis Wirth of the U. S. National Museum. Dr. Wirth and the senior writer are preparing a monograph of the *Culicoides* of Panama, and three papers describing thirteen new *Culicoides* have already appeared.

GROSS RESULTS: Notes on distribution of the various species will be treated in a series of short papers. It should be remembered that certain genera of mosquitoes are diurnal and are not readily attracted to light. The following short table presents a general idea of the enormous quantities of mosquitoes, *Culicoides* and *Phlebotomus* collected during these surveys in Panama. A great many species, many of which are new to Panama and some new to science, have been found in these surveys.

	1951	1952	1953 (Through Aug.)
Mosquitoes	73,615	70,867	96,091
Culicoides	105,586	235,555	84,000
Phlebotomus	6,114	31,417	1,492

In addition to these surveys a number of light traps were operated during June of 1952 in Puerto Rico, the results of which will be published later.

ACKNOWLEDGMENTS: The writers are grateful to the personnel of the Inter-American Geodetic Survey who cooperated in the work in Darien. The writers are grateful to Drs. Hertig and Fairchild of the Gorgas Memorial Laboratory, Dr. Willis W. Wirth of the U. S. National Museum and also the many field workers and laboratory workers of the 25th Medical Detachment who have had an active part in this work. Much of the field work was done by Sgts. R. F. Bennett, H. W. Lillis, R. N. Lindenmuth, Lester Rosin, and Ronald Parsons. Others who have helped in the field work or laboratory have been as follows: Sfc. Cliven Beauregard, Sfc. Winfred Mullins, Cpl. R. R. Pieffer, Cpl. N. Miyamoto, Pfc. John T. Haas, Pfc. R. J. Schiller, and

also Hector Baxter, Luis Pinzon, Louis Palma and Wilbur Lowe of the Malaria Control Force.

Summary: The 25th Medical Detachment has conducted light trap surveys in Panamà since 1951. A total of almost 150 localities have been surveyed one or more times using New Jersey-type mosquito light traps and the Shannon trap. In addition some traps have been operated in Puerto Rico. During this time approximately 240,573 mosquitoes, 425,141 *Culicoides,* and 39,023 *Phlebotomus* have been collected. A series of short papers will be published later giving the distribution of mosquitoes. Also, much of this material is being used in taxonomic studies by the writers.

"OPERATION MERCY" [1]

DONALD R. JOHNSON [2]

During the monsoon season of 1954 unprecedented floods created emergency conditions in East Bengal province of Pakistan. This is one of the most heavily populated sections of the world with an estimated 42,000,000 persons in an area of 54,000 square miles, which is approximately the size of the State of Florida. Three great rivers, namely the Brahmaputra, Ganges and Meghna flow through the flat fertile countryside of Bengal and during the monsoon season each year cause flood conditions. During 1954 the greatest floods in recent history inundated an estimated 15,000 square miles of East Bengal.

The two most serious infectious diseases in East Bengal are malaria and cholera. Malaria is the No. 1 killer of the province but cholera is more dramatic because of the explosive nature of outbreaks which result in high percentages of mortality. This is one of the few remaining foci of cholera in the world. Outbreaks of these two diseases were feared following the wake of the flood.

A call for help was cabled to the United States during the second week of August by the American Consul in Dacca. Urgency was placed upon the need for medical supplies and health workers. Within a few hours after the appeal was received in Washington, supplies and medical personnel were en route to Pakistan. The Public Health Service provided U. S. Foreign Operations Administration with a team of six persons for the flood emergency. The speaker was fortunate enough to be selected as the entomologist for this team. Mr. Joseph H. Coffey, sanitary engineer, also was assigned to the team to assist with malaria and mosquito control measures. This relief mission under the leadership of Dr. Alexander D. Langmuir, epidemiologist, was also staffed by Dr. William H. Clark, epidemiologist, Mr. Robert D. Shannon, administrative officer and Mr. Kenneth C. Lauster, sanitary engineer.

In order to illustrate the rapidity of this operation, Dr. Langmuir and the speaker were asked on August 13 if they would be willing to go to Pakistan. A short 43 hours later, on August 15, they left for Pakistan, arriving in Dacca in the center of the flooded area on August 19. Tons of medical supplies, including more than 30,000,000 anti-malarial tablets, had already arrived, airlifted there from various

[1] Presented at the 11th Annual Meeting of the American Mosquito Control Association, January 26, 1955, in Los Angeles, California.

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parts of the world via U. S. Air Force Globemasters and Flying Boxcars. In addition, 168 U. S. Army preventive medicine personnel had arrived from Korea, Japan and elsewhere. These Army men were integrated with Pakistani Army counterpart personnel and quickly began inoculating the local inhabitants against cholera in the flooded area.

The mosquito problem was very serious in the population centers of the flooded area. Refugees were crowded into school houses and other public buildings where they slept on the floor and "existed" for weeks waiting for the flood waters to recede. They were plagued by hordes of mosquitoes, mostly culicines. Although malaria is a serious problem throughout most of the year, floods actually *decrease* the danger from malaria because the normal breeding places of larvae of *Anopheles philippinensis,* the principal vector, are flushed away by flood waters. It is not until floods recede that *philippinensis* populations build up in the water ponds scattered through the country. However, this particular flood created excellent breeding places for other mosquito species.

Emergency spraying was made possible because of the 10 tons of dieldrin 50 per cent wettable powder and 250 compression sprayers procured for Pakistan by the U. S. Foreign Operations Administration and airlifted there by the U. S. Air Force planes. Refugees whose quarters were sprayed expressed their deep appreciation following these insecticidual applications. They stated that they were able to sleep comfortably for the first time in many nights. Even though malaria did not appear to be an immediate danger to these refugees, the humanitarian aspects of such sprayings more than justified the use of the materials and labor for pest control. During the post-flood period, no epidemics of malaria, cholera or any other diseases were reported in the province. Pakistan Government officials were extremely grateful to the United States for aid given by our country.

In addition to the immediate benefits resulting from this emergency program, a great deal of progress toward permanent improvement of the public health of the Province was made during the period in which this emergency flood relief mission stayed in East Bengal. A long range malaria program was discussed with Pakistani officials and ways of implementing it were planned. Although an estimated 3,000,000 persons throughout East Bengal were already protected by the regular control activities against malaria, the U. S. Public Health Service relief mission personnel envisioned the possibility of extending this program to all of the 42,000,000 population living in this province. This will require reorganization of the present program and additional assistance from international organizations such as FOA and United Nations agencies. It is hoped that the expanded program can be started during 1955.

PICTORIAL KEYS TO THE GENERA OF PANAMA MOSQUITOES

E. L. PEYTON,[1] PEDRO GALINDO,[2] AND FRANKLIN S. BLANTON [3]

A number of pictorial keys have recently been published on mosquitoes of medical importance for various strategic areas of the world, (Cook, 1954; Foot, 1953, 1954; Pratt and Goodman, 1948; Sommerman, 1953; Sommerman and Foote, 1953), and it is understood that others are in various stages of preparation. As pointed out by these authors the purpose of these pictorial keys is to assist public health workers in rapidly separating and identifying the mosquito species of primary medical importance.

These papers deal with the species known or thought to be vectors of disease and are specifically written to exclude species other than those known or believed to be vectors of disease.

The present paper is different in that it deals with the separation of genera. It is thought that this will be especially useful in the training of beginners in the identification of Panama mosquito genera. Such keys will not in any way conflict with but will aid pictorial keys to the species of medical importance. The only keys available for the mosquito genera of Panama are Dyar (1925 and 1928) and these are now incomplete and unsatisfactory.

It has been our experience that a key of the type presented here is very valuable for training purposes. In the early part of 1951 the authors began an extensive light trap survey of mosquitoes in the Canal Zone and adjacent areas. Tentative identification was made by the enlisted personnel of the 25th Preventive Medicine Survey Detachment and the technicians of the Malaria Control Force. During the three years that this survey was being conducted new personnel were under constant training in mosquito taxonomy.

For training technicians the U. S. Genera of Mosquitoes (Female and Larvae) by Pratt and Goodwin (1948) was very useful, but these keys of United States mosquitoes had limitations since Panama has several genera that do not occur in the United States. These limitations often caused confusion for the student.

How to use the key: This key, like many other keys, merely offers short cuts to identification by the process of elimination. One should start at the top of the page and follow the arrows down to the bottom of the page. The beginner is cautioned not to skip steps and take characters for granted, since such careless haste will lead to confusion, and create impressions that will impede progress. The beginner should study the characters stressed in these keys until they are thoroughly familiar. It will be noted that where the prespiracular space is mentioned in the adult key we have referred to figures 1, 2, and 3 at the beginning of the key to avoid duplication. Seventeen different genera are known to occur in Panama. Of these, three are each represented by a single species; *Aedeomyia squamipennis, Chagasia bathanus,* and *Culiseta maccrackenae.*

Identification of the adult female is relatively easy; however, in the larval stage difficulties are encountered as pointed out in the key. There are a few species of *Aedes,* particularly in the *leucocelaenus* group and the subgenus *Howardina,* that cannot be separated generically from *Haemogogus.* For the purpose of this key the writers therefore say that the two genera are inseparable, although the majority of species can be separated. Of the tribe *Sabethini* there are four genera represented; *Trichoprosopon, Limatus, Sabethes* and *Wyeomyia.* These four genera are extremely difficult to separate

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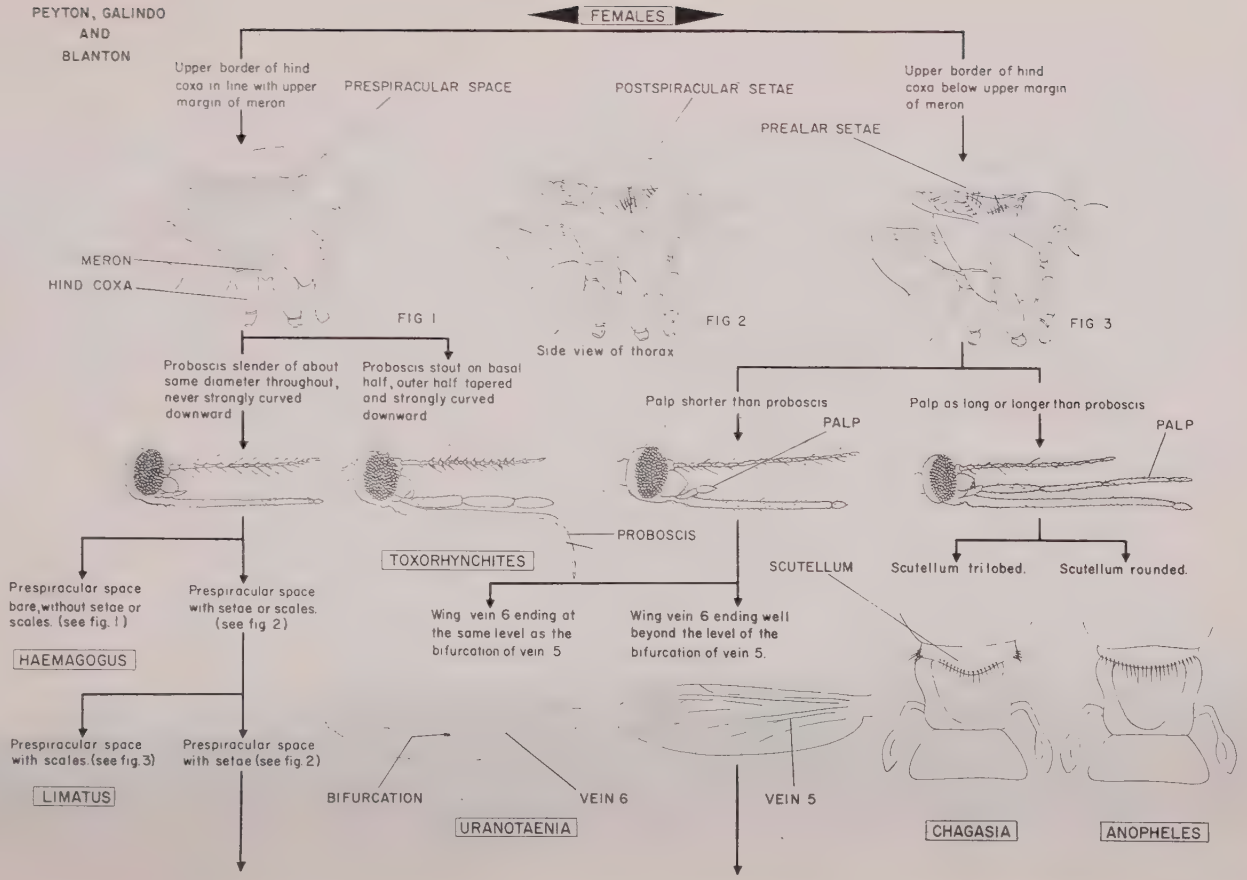
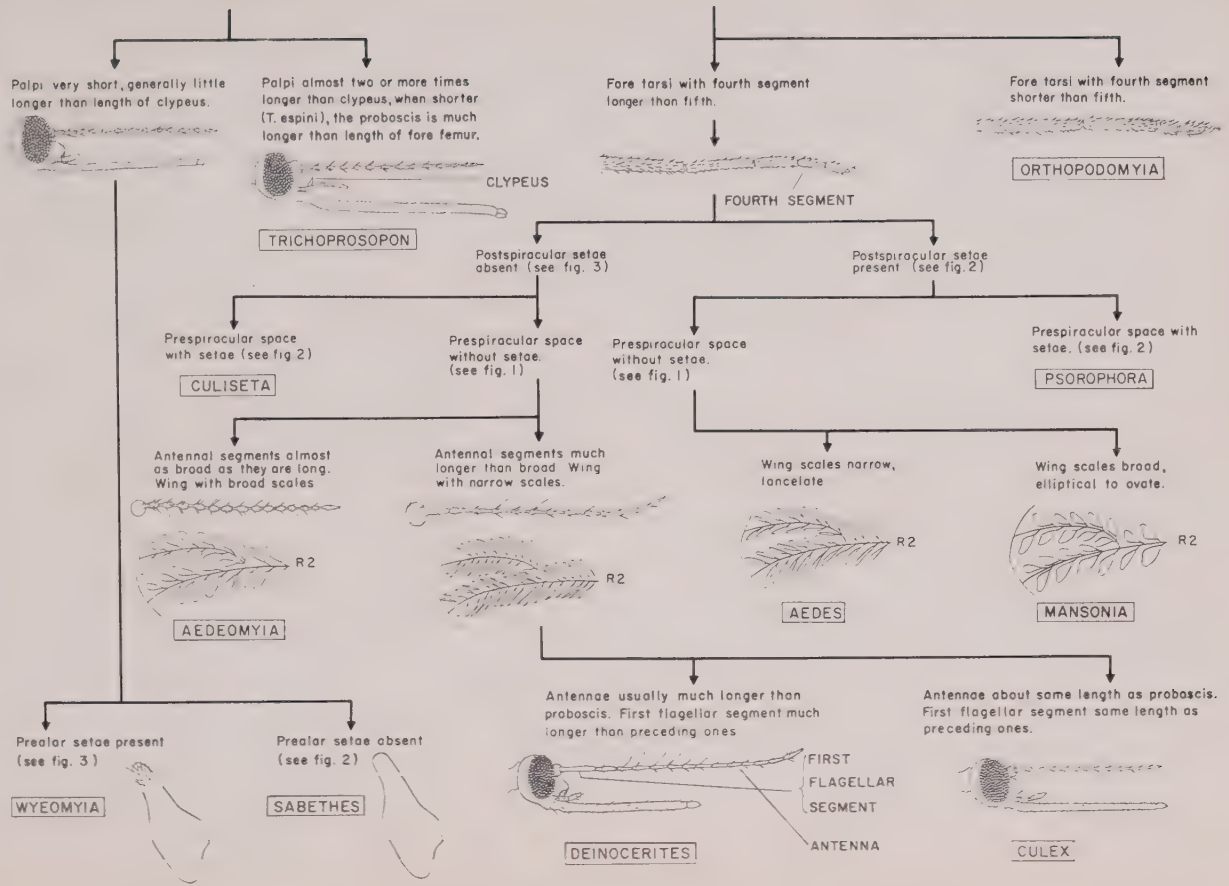
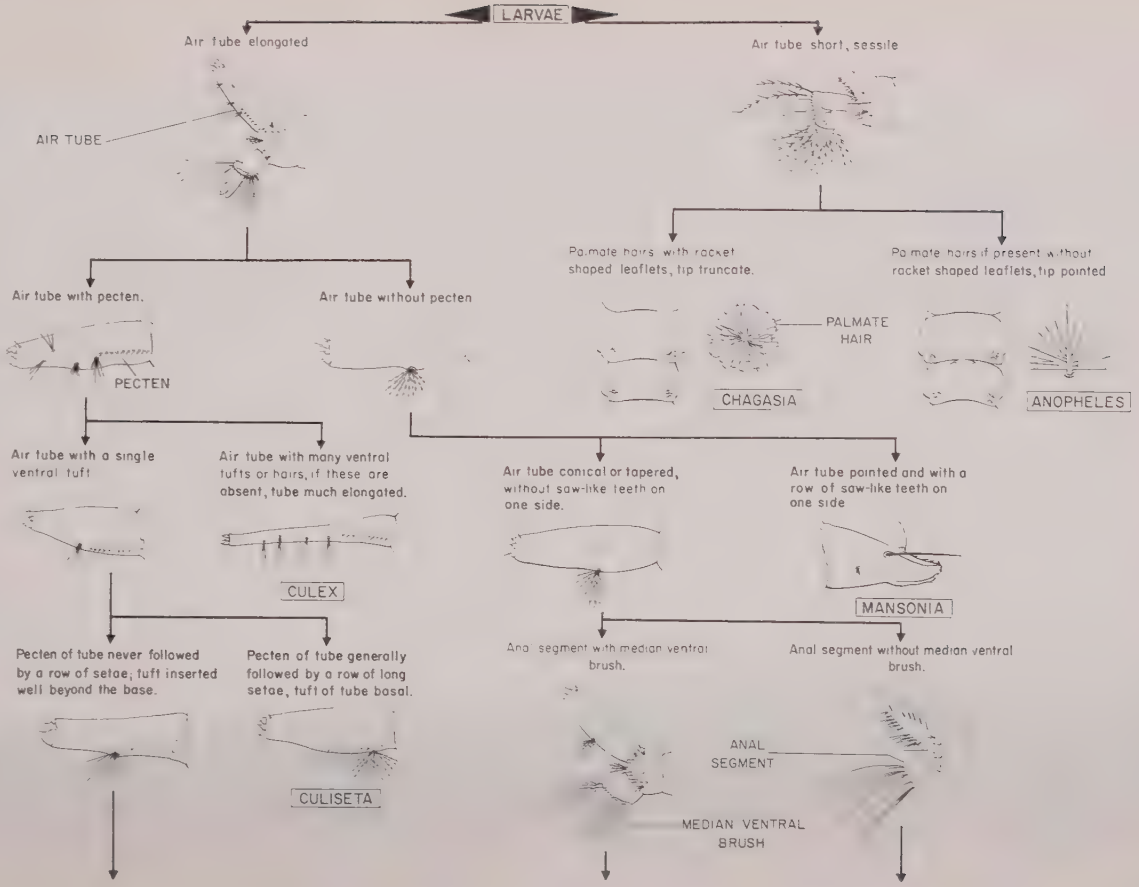
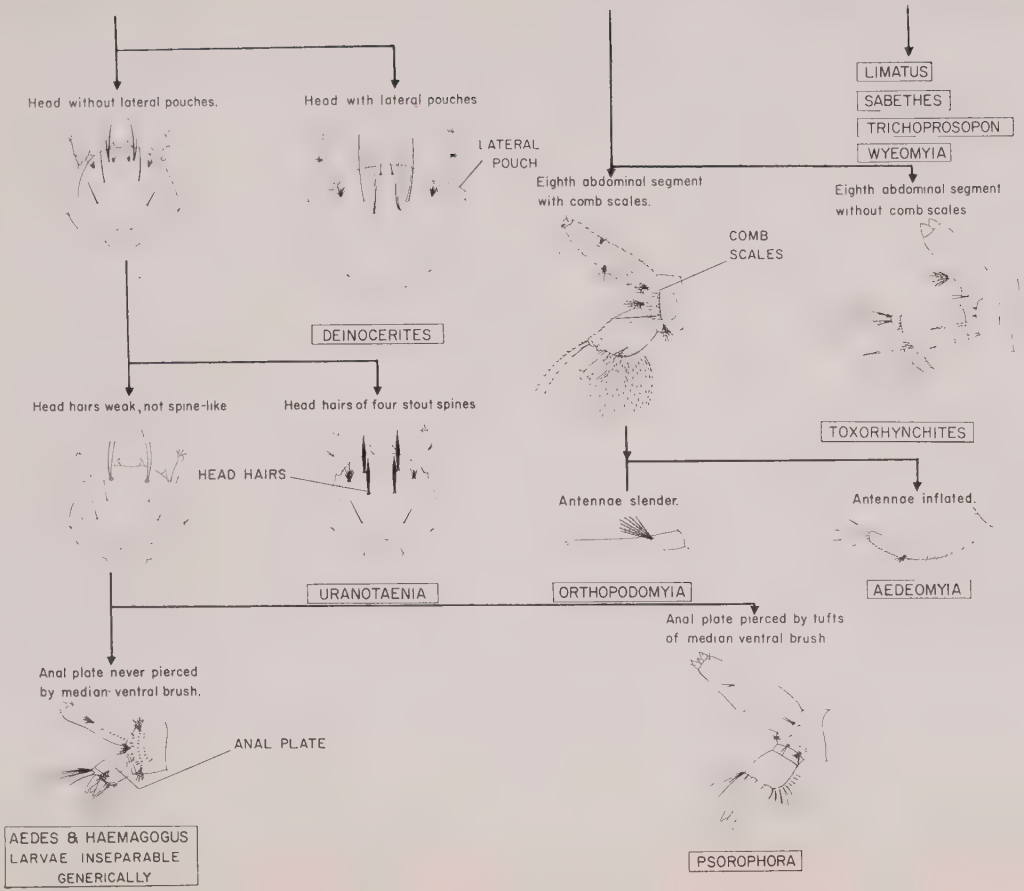

FEMALES
Upper border of hind coxa in line with upper margin of meron
PRESPIRACULAR SPACE
POSTSPIRACULAR SETAE
Upper border of hind coxa below upper margin of meron
PREALAR SETAE
MERON
HIND COXA
FIG 1
FIG 2
Side view of thorax
FIG 3
Proboscis slender of about same diameter throughout, never strongly curved downward
Proboscis stout on basal half, outer half tapered and strongly curved downward
Palp shorter than proboscis
PALP
Palp as long or longer than proboscis
PALP
PROBOSCIS
TOXORHYNCHITES
SCUTELLUM
Scutellum trilobed.
Scutellum rounded.
Prespiracular space bare, without setae or scales. (see fig. 1)
Prespiracular space with setae or scales. (see fig. 2)
HAEMAGOGUS
Wing vein 6 ending at the same level as the bifurcation of vein 5
Wing vein 6 ending well beyond the level of the bifurcation of vein 5.
Prespiracular space with scales. (see fig. 3)
Prespiracular space with setae (see fig. 2)
LIMATUS
BIFURCATION
VEIN 6
URANOTAENIA
VEIN 5
CHAGASIA
ANOPHELES


Palpi very short, generally little longer than length of clypeus.
Palpi almost two or more times longer than clypeus, when shorter (T. espini), the proboscis is much longer than length of fore femur.
CLYPEUS
TRICHOPROSOPON
Fore tarsi with fourth segment longer than fifth.
Fore tarsi with fourth segment shorter than fifth.
ORTHOPODOMYIA
FOURTH SEGMENT
Postspiracular setae absent (see fig. 3)
Postspiracular setae present (see fig. 2)
Prespiracular space with setae (see fig. 2)
CULISETA
Prespiracular space without setae. (see fig. 1)
Prespiracular space without setae. (see fig. 1)
Prespiracular space with setae. (see fig. 2)
PSOROPHORA
Antennal segments almost as broad as they are long. Wing with broad scales
R2
AEDEOMYIA
Antennal segments much longer than broad. Wing with narrow scales.
R2
Wing scales narrow, lanceolate
R2
AEDES
Wing scales broad, elliptical to ovate.
R2
MANSONIA
Prealar setae present (see fig. 3)
WYEOMYIA
Prealar setae absent (see fig. 2)
SABETHES
Antennae usually much longer than proboscis. First flagellar segment much longer than preceding ones
FIRST FLAGELLAR SEGMENT
ANTENNA
DEINOCERITES
Antennae about same length as proboscis. First flagellar segment same length as preceding ones.
CULEX


LARVAE
Air tube elongated
Air tube short, sessile
AIR TUBE
Palmate hairs with racket shaped leaflets, tip truncate.
Palmate hairs if present without racket shaped leaflets, tip pointed
PALMATE HAIR
CHAGASIA
ANOPHELES
Air tube with pecten.
Air tube without pecten
PECTEN
Air tube with a single ventral tuft
Air tube with many ventral tufts or hairs, if these are absent, tube much elongated.
Air tube conical or tapered, without saw-like teeth on one side.
Air tube pointed and with a row of saw-like teeth on one side
CULEX
MANSONIA
Pecten of tube never followed by a row of setae, tuft inserted well beyond the base.
Pecten of tube generally followed by a row of long setae, tuft of tube basal.
Anal segment with median ventral brush.
Anal segment without median ventral brush.
CULISETA
ANAL SEGMENT
MEDIAN VENTRAL BRUSH


Head without lateral pouches.
Head with lateral pouches
LATERAL POUCH
DEINOCERITES
Head hairs weak, not spine-like
Head hairs of four stout spines
HEAD HAIRS
URANOTAENIA
Anal plate never pierced by median ventral brush.
ANAL PLATE
AEDES & HAEMAGOGUS LARVAE INSEPARABLE GENERICALLY
LIMATUS
SABETHES
TRICHOPROSOPON
WYEOMYIA
Eighth abdominal segment with comb scales.
COMB SCALES
Eighth abdominal segment without comb scales
TOXORHYNCHITES
Antennae slender.
Antennae inflated.
ORTHOPODOMYIA
AEDEOMYIA
Anal plate pierced by tufts of median ventral brush
PSOROPHORA

from each other in the larval stage. We have, therefore, made no attempt to separate them here. According to Lane and Cerqueira (1942) *Sabethes* and *Limatus* can be separated from *Trichoprosopon* and *Wyeomyia* by the mouth parts but this is too difficult for the beginner. The writers feel that the student should be well advanced in the identification of mosquitoes before attempting to separate this difficult group of genera.

There are a number of species of *Aedes* in Panama, the larvae of which have the anal segment completely ringed by the plate; however, the tufts of the median ventral brush are posterior to the plate and never pierce it as in *Psorophora*.

Acknowledgments: The writers wish to acknowledge the help of Mr. Hector G. Baxter of the Malaria Control Force who prepared most of the slides and assisted a great deal in the arrangement of the drawings. We also wish to acknowledge the help of Mr. Victor Barria of the Malaria Control Force who prepared the drawings under the direction of the senior writer.

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Do you know the latest methods employed in mosquito control? Do you know what insecticides seem to have lost their effectiveness against mosquitoes, and where these indications of resistance have developed? Do you know how best to convince your commissioners of your abatement district needs? Come to the AMCA meetings in Beaumont, Texas, February 5–8, 1956, and learn the answers from other workers' experiences.

EDITORIAL

QUALITY, BREVITY, ECONOMY

One of the satisfactions of having studied with a great teacher is the memory of occasional words of praise for a piece of work well done. Equally fresh in the memory, but perhaps with their sting happily dulled by time, may be words of disapproval evoked by carelessness or superficiality. It is only fair, therefore, for the Editor, before accusing others of a crime, to admit that he is guilty, on occasion (such as the present), of the same crime: the crime of verbosity.

As a graduate student, sitting in awe and admiration at the feet of William Morton Wheeler and George Howard Parker, the Editor once submitted a manuscript of some 150 pages to Professor Parker. It was promptly returned with the remark that any good thoughts would be almost certainly buried in all those words, and that it might just as well be cut in half before going any further. The manuscript was cut down by about 50 pages and resubmitted. This time it came back with the written comment "Evidently you do not understand what a sound condensation means." The third time, after another shaking-down in which most of the words of more than three syllables and most of the tables were tossed out bodily, it began to win at least a small amount of approval, and the comment came back: "Good! Now it looks as if you are almost ready to begin to write it."

The Editor has such a high respect for the talent and learning represented among the contributors to *Mosquito News* that it is only with the greatest reluctance that he asks for revisions of their manuscripts, or for the condensations which can so often be made by the elimination of tables and superfluous illustrations. But the plain fact is that tables and illustrations cost money. Some are essential, others, if not essential, add greatly to the value of a paper. But sometimes a photograph is included just because the author took it, and could not bring himself to omit it. With a few papers the impression is inescapable that they represent an unedited portion of an annual report or a transcript of field notes. The Editor feels that truly significant points are often masked, and potentially good papers often spoiled by authors who are in such a hurry to get on to the next piece of work that they rush the deadline with papers which on more leisurely consideration they would have shortened by many words.

The necessity for brevity is real; it is dictated by the need for economy. A full page of tabular material costs about four times as much as a page of 10-point type, and fractions of a page in the same proportion. It is often cheaper to make a line cut of a table than to set a full page of tabular material in type, but for a line cut a table must be perfectly neat and clean, and the typing must be sharp, black and clear.

If there are several illustrations, often much time and expense can be saved if they are so chosen that they will all take the same amount of reduction and can be trimmed and fitted to make a full page or half page plate, or a vertical cut of column width. Labels and key numbers and letters should not be so placed that they extend so far into the margins as to prevent an otherwise permissible reduction to column or page width.

All authors should read and follow the manuscript rules and regulations printed on the inside back cover of *Mosquito News*. Both the Editor and the printer have been extremely lenient in the interpretation and enforcement of these rules, but this is a good opportunity to mention that every violation is expensive to the Association. For instance, although the printer might accept and work from a carbon on thin paper, it is more difficult

to handle, takes more time to read, and will result in more errors for the proofreaders to correct; THE ASSOCIATION PAYS FOR ALL OF THIS EXTRA TIME AND LABOR.

The author can estimate very easily how many pages his paper will require, and should try to tailor it down to six. If it appears that his text plus illustrations cannot be made to fit on six pages—and it should certainly be admitted that many such occasions arise—a statement should accompany the manuscript authorizing charges for extra pages and giving the name of the person to whom the bill should be sent.

Most authors and organizations willingly provide for and pay these charges, and *Mosquito News* takes pleasure and pride in presenting long papers of a significant nature in this way. But, returning to the subject of condensation when it can be accomplished without sacrifice of quality, the Editor is reminded of the old rule for pruning a tree: cut out everything you think the tree can stand, then back away, look it over, and go back and take out half as much again. This applies to nearly all writing and to nearly all writers, so "never send to know for whom the bell tolls; it tolls for thee."—D.L.C.

Woodleaf Star Route
Box 3081
Oroville, California
May 27, 1955

DR. DONALD L. COLLINS, Editor,
Mosquito News,
New York State Museum,
Albany 1, N. Y.

Dear Don:

I would like to have you present, through "Mosquito News," my profound thanks to my many friends who were so kind to me at the Los Angeles Meeting in January of this year. I was too overwhelmed to adequately express my appreciation, and actually I think I was in a daze during the entire meeting. I shall always treasure the many beautiful and useful gifts presented to my wife and myself, and the two honorary memberships, and especially that wonderful book of letters. This now has a special stand in my office. The sincerity and kindness of these letters are heart warming, and give me a feeling that I have really been of some use in this world.

I had hoped to be able to reply to these letters individually, but a serious illness and operation from which I am recovering but slowly has prevented my doing so, and belated replies now appear to be inappropriate. It may be several months before I will be fully recovered, and even then I will have to proceed at a much slower pace than in past years. In the meantime we have purchased and moved to a lovely place in the Sierra foothills five miles southeast of Oroville in California, and we hope that our friends will call on us when they are in the vicinity. They will receive a hearty welcome.

Sincerely yours,

HAROLD F. GRAY

ASSOCIATION NEWS

MINUTES OF THE 11TH ANNUAL MEETING OF THE AMERICAN MOSQUITO CONTROL ASSOCIATION HELD AT LOS ANGELES, CALIFORNIA, JANUARY 23–27, 1955

Recorded and Reported by Fred H. Stutz

Board of Directors: 8:00 P.M., January 23, 1955. The Board of Directors of the American Mosquito Control Association was convened at 8:00 P.M. January 23, 1955, at the Statler Hotel, the convention headquarters, in Los Angeles, California, by President Dorer.

Those present were: C. R. Twinn, F. C. Bishopp, Don M. Rees, R. F. Peters, R. L. Vannote, L. W. Smith, T. G. Raley, C. M. Gjullin, Wm. E. Bickley, Donald Collins, S. V. Minnich, G. Edwin Washburn, Otto McFeely, Fred H. Stutz and Thomas D. Mulhern and others, who came and left during the meeting.

The first motion was made by Lester W. Smith: That the minutes as published in the June 1954 issue of *Mosquito News* be approved. Seconded by S. V. Minnich and carried.

It was moved by S. V. Minnich that the report of the seminar held at Toledo, Ohio, September 29–October 1, 1954, be approved as submitted. Seconded by Don Rees. Carried. Attachment 1.

President Dorer announced the appointment of the following to the Resolutions Committee: John M. Hirst, Chairman; T. D. Mulhern, and Jack Kimball. He then gave a report. Attachment 2.

President Dorer added that a meeting was to be held the first week in February at Amherst, Massachusetts, for the purpose of organizing a New England Mosquito Control Association; and that Publication #3, "Mosquito Culture Techniques and Experimental Procedures" by Helen Louise T. Durkee is ready for distribution at $2.00 per copy; that its sale would be handled by C. T. Williamson, Yaphank, L. I., New York.

It was moved by S. V. Minnich that the report of the President be accepted. Seconded by Lester W. Smith. Carried.

Richard F. Peters moved that a special meeting of the Association be held Monday morning to act on a petition requesting that Harold F. Gray be immediately elected to honorary membership in the Association, and that a special memento be presented to him at the banquet Monday night. Seconded by C. M. Gjullin. Carried. Attachment 3.

Past President F. C. Bishopp, Chairman of the Nominating Committee, presented the report of this committee, and moved its acceptance. Seconded by Otto McFeely. Carried. Attachment 4.

Treasurer L. W. Smith presented a comprehensive financial report of the affairs of the Association. S. V. Minnich moved its acceptance. Seconded by G. E. Washburn. Carried. Attachment 5.

Mr. Smith then read a report for C. T. Williamson on the financial status of AMCA Bulletin 2. It was moved by S. V. Minnich that the report of Mr. Williamson be accepted. Mr. Washburn seconded. Carried. Attachment 6.

A Report on the Examination of the Treasurer's Account was received from Nathan Lipman, CPA. Dr. Bishopp moved the acceptance of the report. Seconded by Otto McFeely. Carried. Attachment 7.

The Treasurer presented a budget estimate for the year 1955. After discussion and modification, it was moved by S. V. Minnich that the attached budget be approved. Seconded by Don Rees. Carried. Attachment 8.

Executive Secretary Raley read a report of the Committee on Bylaws. The report engendered a long discussion but no action. Attachment 9.

Secretary Raley made a report of his

correspondence with the Secretary of the American Association for the Advancement of Science pertaining to the inequalities in pay of the Armed Forces Career Compensation Act. The following is a quotation from the Secretary of the A.A.A.S. dated October 29, 1954:

> "Unfortunately, our agenda was an extremely heavy one and so the matter was simply tabled to await a later meeting when we might have an opportunity for a more detailed consideration of whether or not the Association can actively go to work on this problem."

The question of funds available for the payment of Bulletin #3 was discussed. It was brought out that Association funds were being held by members other than the Treasurer, and it was the feeling that all funds such as Good Neighbor, Special Publications Committee, and any other monies held for the benefit of the Association should be turned over to the Treasurer. Richard Peters moved that all funds belonging to or held for the credit or benefit of the Association be turned over to the Treasurer. Seconded by Dr. Bishopp. Carried.

The meeting was adjourned.

SPECIAL BUSINESS MEETING, JANUARY 24, 1955. At the regular Monday morning (January 24) Program Meeting held at 9:50 A.M., President Dorer convened a Special Business Session of the Association to consider a petition requesting that Harold F. Gray be made an honorary member of the AMCA. This was done at a special meeting so that a certificate could be presented to Mr. Gray at the evening banquet. Richard Peters moved that Mr. Harold F. Gray be elected to honorary membership. Don Rees seconded. Carried.

There being no further business, the President adjourned the meeting.

FIRST GENERAL SESSION, MONDAY, JANUARY 24, 2:45 P.M. At the regular Program Session at 2:45 P.M. Monday, January 24, the President announced the report of the Nominating Committee. No action was necessary.

SECOND GENERAL SESSION, TUESDAY, JANUARY 25. Prior to commencement of the regular afternoon program meeting at 1:40 P.M. Tuesday, January 25, President Dorer convened a business session for the election of officers. The report of the Nominating Committee was re-read. The President called for nominations from the floor. There being none, Robert L. Vannote moved that the nominations be closed. Seconded by Harold F. Gray. Carried.

Dr. L. W. Hackett moved that the Secretary be instructed to cast an unanimous ballot for those nominated. Seconded by George A. Thompson. Carried. Attachment 4.

SECOND MEETING, BOARD OF DIRECTORS, 7:00 P.M., JANUARY 25. The second meeting of the Board of Directors of the American Mosquito Control Association was held at 7:00 P.M. January 25, 1955.

The meeting was called to order by President Dorer. Those present were: T. G. Raley, Lester W. Smith, Dr. Don M. Rees, Richard F. Peters, Dr. B. B. Pepper, G. Edwin Washburn, Fred H. Stutz, Dr. Donald Collins, Robert L. Vannote, C. F. Scheel, and others.

Commander Hirst reported for the Special Publications Committee. Mr. Washburn moved that the committee be thanked for their fine work in publishing Bulletin #3; further, that payment be authorized in the amount of $1,351.05. Seconded by Dr. Rees. Carried.

Executive Secretary Raley read Report of the Good Neighbor Club AMCA for 1954. Richard Peters moved that the report be accepted and that Miss Helen Sollers be complimented and thanked for her successful efforts in keeping 25 subscriptions going to fellow workers in foreign countries. Seconded by Lester W. Smith. Carried. Attachment 10.

A delegation from Jefferson County, Texas, composed of Dr. Paul R. Meyers, Mr. George A. Thompson, and Mr. Gish, appeared before the Board to request that

the 1956 meeting of the Association be held in Beaumont, Texas, on approximately the 5th, 6th and 7th of February. This is the third year that an invitation has been received from Texas. In view of the mosquito work that is being carried on in Texas, it was felt that the invitation to Beaumont should be accepted. Mr. Washburn moved that the invitation to Beaumont, Texas, be accepted. Seconded by Mr. Stutz. Carried.

The President adjourned the meeting untin 9:00 A. M. January 26.

THIRD MEETING, BOARD OF DIRECTORS, 9:25 A.M. JANUARY 26. President Dorer reconvened the meeting of the Board of Directors at 9:25 A.M. January 26, 1955.

Austin Morrill presented the report for the Committee on Research and Development. Lester Smith moved its acceptance. C. M. Gjullin seconded. Carried. Attachment 11.

Richard F. Peters presented report of the Publications Committee. Dr. Collins discussed various aspects of the editing and publication of *Mosquito News*. Dr. Rees made the following motion:

> "I move to accept the report of the Publications Committee with a vote of thanks and commendation to members of the Committee, especially sanctioning paragraph three commending Dr. Donald L. Collins, Editor of *Mosquito News*. Also, a sincere vote of thanks to his secretary, Mrs. Margaret Slater for the outstanding service she is rendering AMCA."

Seconded by Lester W. Smith. Carried. Attachment 12.

Otto McFeely presented in writing suggested changes in the format of *Mosquito News*. The material was turned over to the Publications Committee for consideration.

Richard F. Peters moved: That the editor of *Mosquito News* be given authority to permit the reprinting of articles and papers printed in *Mosquito News*, if in his opinion such is desirable; provided, however, that proper credit be given to *Mosquito News*. Seconded by S. V. Minnich. Carried.

The matter of the report of the Bylaws Committee was reopened. After discussion, it was moved by Lester W. Smith that the report be accepted and referred to the membership at the general meeting. Seconded by Dr. Rees. Carried.

T. G. Raley made a report for the Membership Committee. He moved that all applicants for active membership be approved. Seconded by Lester W. Smith. Carried. Attachment 13.

Lester W. Smith moved that report of the Membership Committee be accepted. Seconded by Dr. Rees. Carried.

T. G. Raley read the Report of the Committee on Legislation. He moved its acceptance. Seconded by Richard F. Peters. Carried. Attachment 14.

There being no further business to come before the Board, the meeting was adjourned at 11:20 A.M.

THIRD GENERAL SESSION, MAIN BUSINESS SESSION, WEDNESDAY, JANUARY 26, 4:35 P.M. The meeting was called to order at 4:30 P.M. January 26, by President Dorer.

Mr. Washburn moved that the minutes as published in the June 1954 issue of *Mosquito News* be approved. Seconded by Dr. Bishopp. Carried.

Dr. Wm. E. Bickley presented Report on Advertising in *Mosquito News* for the year 1954. Lester W. Smith moved that the report be accepted and that Dr. Bickley be thanked for the outstanding job he did during the past year in increasing the revenue from advertising. Seconded by Commander Hirst. Carried. Attachment 15.

Commander Hirst reported to the membership that Bulletin #3 is ready for distribution. Dr. Bishopp moved that the Committee be thanked for an excellent job. Seconded by Harold F. Gray. Carried.

Dr. Collins discussed *Mosquito News* and gave figures as to the classification of the articles published.

Austin Morrill, Jr. asked that material

suitable for publication in News and Notes be sent to him.

Dr. Pepper read the Report of the Committee on Bylaws. He discussed the report and the articles affected by the recommendations of the Committee. Commander Hirst moved that the report be accepted and that the changes in the bylaws recommended in the report be made at this time. Seconded by Mr. Gray. Carried. Attachment 9.

Secretary Raley moved that the agreement pertaining to the publication of papers to be presented at this joint meeting, which had been previously approved by mail by the Board of Directors, be approved by the membership. Seconded by R. L. Vannote. Carried. Attachment 16.

Secretary Raley moved that motion made and carried by mail ballot for the Association to contribute $70.00 toward the expense of *Mosquito News* Editor Collins to this meeting be approved. Dr. Bishopp seconded. Carried.

Secretary Raley moved that motion made and carried by mail ballot for the Association to pay the hotel expense of President Dorer be approved. Seconded by Thomas Mulhern. Carried.

Secretary Raley read communications from H. H. Stage, Dr. H. P. S. Gillette, Trinidad, BWI, and Mr. Walter D. Henderson.

He then read the Auditor's Report to the membership. Mr. Mulhern moved its acceptance. Seconded by Richard Peters. Carried.

The Report of the Membership Committee was read. S. V. Minnich moved its acceptance. Seconded by Dr. Pepper. Carried.

Secretary Raley read the Report of the Research and Development Committee and moved its acceptance. Dr. Collins seconded. Carried.

Dr. Twinn moved that the membership compliment Executive Secretary Raley for the very fine job he is doing for the organization. Dr. Bishopp seconded. Carried.

The Secretary announced to the membership that the next meeting would be held in Beaumont, Texas, about February 5, 1956.

Commander John M. Hirst, Chairman of the Resolutions Committee, presented the following resolutions and moved their adoption. The resolutions were acted upon separately.

— 1 —

WHEREAS, The 1955 Annual Meeting of the American Mosquito Control Association held jointly with the California Mosquito Control Association at Los Angeles has been marked by the presentation of many excellent papers, well attended sessions, an outstanding program of entertainment, particularly for our ladies, and comfortable quarters, therefore

BE IT RESOLVED: That this Association expresses its appreciation to its host, the California Mosquito Control Association, to the Program Committee and the Arrangements Committees, to the speakers for their contributions, to the exhibitors who have presented fine displays, and to all others who have contributed in any way to the success of this convention.

Seconded by Harold F. Gray. Carried.

— 2 —

WHEREAS, The Joint Annual Meeting of the American Mosquito Control Association with the California Mosquito Control Association has been dedicated as a tribute to Harold Farnsworth Gray in appreciative recognition of his dynamic influence upon and his outstanding contributions to the field of mosquito abatement, and

WHEREAS, The Board of Directors of the American Mosquito Control Association has taken appropriate action by awarding him an honorary life membership, therefore

BE IT RESOLVED: That the entire membership, individually and collectively, use this means to express their gratitude to Harold Farnsworth Gray, Past President, committee worker extraordinary, and good fellow, for his untiring

efforts in the development of the American Mosquito Control Association, and for his constant sympathetic attention and inspirational advice to all.

Seconded by Dr. Bishopp. Carried.

—3—

Whereas, American Mosquito Control Association Bulletin #3, "Mosquito Culture Technique," authored by Mrs. Helen Louise Trembley Durkee, has become an actuality, and

Whereas, This publication is an important contribution to the literature concerning mosquitoes and the techniques for working with them, and

Whereas, Many committees of the Association, and many individuals within and without the Association have contributed to this new bulletin and its publication, therefore

Be It Resolved: That this Association commends Mrs. Durkee for her efforts, and expresses its appreciation to all who have in any way aided in the successful completion of this publication.

Seconded by George A. Thompson. Carried.

—4—

Whereas, Walter D. Henderson, Executive Secretary of the Ocean County Mosquito Extermination Commission of Barnegat, N. J., has since 1949 served efficiently as custodian of the Association library, caring for the reserve supply of copies of "Mosquito News," keeping records thereof and mailing copies to members, subscribers, purchasers and others as ordered by the authorized officers, and

Whereas, This important function has so far not been recognized by any official acknowledgment, although the duties involve a considerable expenditure of time, effort, and care, therefore

Be It Resolved: That the American Mosquito Control Association expresses its appreciation to Walter D. Henderson for a job well done, and its thanks to the Ocean County Mosquito Extermination Commission for providing the storage space and for permitting its executive secretary to serve the national association in this way.

Seconded by T. G. Raley. Carried.

—5—

Whereas, The attention of the American Mosquito Control Association has been directed to the cooperative *Aedes aegypti* mosquito eradication program within the countries associated with the Pan American Sanitary Bureau, and

Whereas, This Association recognizes the importance of this program for the control of the transmission of yellow fever within the countries of the Americas, and

Whereas, Recent studies show that this disease is spreading where controls are inadequate, therefore

Be It Resolved: That this Association hereby alerts its appropriate committees and all of its members to the need for bringing this threatening condition to the attention of all professional workers and societies and public officials who may be able to aid in the extension of the *Aedes aegypti* mosquito eradication program to all areas where this mosquito species is still prevalent.

Seconded by C. M. Gjullin. Carried.

—6—

Whereas, The international vector borne disease control program supported by the United States Government through the Public Health Service, Foreign Operations Administration and agencies of the United Nations such as the World Health Organization and the United Nations Children's Fund have effectively demonstrated the way to a way of life free from vector borne diseases and general improvement of the health and well being of populations of economically underdeveloped countries of the world, therefore

Be It Resolved: That the American Mosquito Control Association expresses

its wholehearted support and encouragement of the future continuation of United States assistance of these international programs.

Copies of this resolution to be sent to: Mr. Harold Stassen, Director, Foreign Operations Adm., Washington, D. C.; Mrs. Oveta Culp Hobby, Secretary, Dept. of Health, Education and Welfare, Washington, D. C.; Dr. H. van Zile Hyde, Chief, Div. of Int. Health, Public Health Service, Dept. of Health, Education and Welfare, Washington, D. C.; Dr. Fred Soper, Director, W.H.O. Regional Office, Washington, D. C.; Director, U. N. Children's Emergency Fund, United Nations, New York; Director, W.H.O., Geneva, Switzerland.

Seconded by C. Donald Grant. Carried.

There being no further business, the President requested Past Presidents Harold F. Gray and Dr. Fred C. Bishopp to conduct the new officers to the platform and present them to the membership. Applause. Adjournment.

FINAL MEETING, BOARD OF DIRECTORS, THURSDAY, JANUARY 27. President Richard F. Peters called the meeting to order at 9:40 A.M. Thursday, January 27.

G. Edwin Washburn moved that the following be named to the Nominating Committee: R. E. Dorer, Central East; Robert L. Vannote, North East; E. M. Becton, South East; Otto McFeely, North Central; Dr. Fred C. Bishopp, Gulf Region; Dr. Archie Hess, Rocky Mountain Region; Wm. C. Frohne, Pacific North West; Edgar A. Smith, Pacific South West; Dr. C. R. Twinn, Canada; Dr. H. P. S. Gillette, Box 556, Port-of-Spain, Trinidad, BWI.

Seconded by Lester W. Smith. Carried.

President Peters appointed the following as Committee Chairmen of the various committees with instructions for the chairmen to appoint their own committee members: (1) Bylaws, Dr. B. B. Pepper; (2) Publication of *Mosquito News,* Dr. C. R. Twinn; (3) Miscellaneous Publications, Com. John M. Hirst; (4) Legislation, John A. Mulrennan; (5) Public Relations, Mrs. Ernestine B. Thurman; (6) Finance, Dr. A. W. Lindquist; (7) Advertising (*Mosquito News*), Dr. Wm. E. Bickley; (8) Membership, Thomas D. Mulhern.

The approval of the above chairmen was moved by Dr. Rees. Seconded by Mr. Dorer. Carried.

The President appointed Dr. Maurice W. Provost as Chairman of the Research and Development Committee. Mr. Dorer moved that the appointment be approved. Seconded by Mr. Washburn. Carried.

Dr. Rees moved approval of the following appointments by the President: Dr. Archie D. Hess, Chairman Good Neighbor Club; Robert L. Vannote, National Advisor; Dr. Donald L. Collins, Editor of *Mosquito News;* Fred H. Stutz, Chairman Program Committee.
Seconded by R. E. Dorer. Carried.

Treasurer Lester W. Smith recommended the appointment of William Thom as Assistant Treasurer, as provided for in the amended by-laws. Dr. Rees moved his appointment. Seconded by Mr. Washburn. Carried.

President Peters appointed the following members to prepare a history of the American Mosquito Control Association: Harold F. Gray, Robert L. Vannote, Dr. Robert Glasgow, Thomas D. Mulhern, T. G. Raley.

No formal action was necessary.

There being no further business, the President adjourned the meeting.

FRED H. STUTZ

ATTACHMENT #1

REPORT OF TOLEDO SEMINAR ON FOGS AND MISTS

Proceeding under the authorization of the Board of Directors of the Association, a committee headed by Mr. Otto McFeely, Regional Director, North Central Region, held a Seminar in Toledo, Ohio, on September 29, 30 and October 1 on the subject "Fogs and Mists for Mosquito Control." The Toledo Area Sanitary District served as host with Dr. P. B. Brock-

way acting as chairman of local arrangements. Assisting Mr. McFeely and Dr. Brockway were Robert L. Vannote, Franklin C. Wray, P. Bruce Brockway, Jr., and employees of the Toledo Area Sanitary District. [Ed. Note: A full account of the Toledo Seminar was given in Vol. 14, No. 4 (Dec. 1954) of *Mosquito News;* photographs appeared in the March, 1955 issue. Printed copies of the Proceedings can be procured by sending $1.00 to Mr. P. Bruce Brockway, Jr., 5015 Stickney Avenue, Toledo 2, Ohio)

ATTACHMENT #2

President's Report to the Board of Directors—A.M.C.A.

January 23, 1955

Members of the Board, it has been a real privilege to serve with you during 1954. The accomplishments of the association, perhaps, have not come up to the high hopes that we held a year ago, but it is good to report that the state of the Association is improved and 1954, while not sensational, has been a year of continuous progress.

The reports to be made later by the various committees and officers will substantiate this fact, and I wish to thank all of you for your fine cooperation and hard work.

Most of you will recall the last annual meeting at Atlantic City, which was one of the best of our annual affairs. The fine cooperation of the New Jersey Association was wonderful, and special commendation should go to Dr. Pepper, Dan Jobbins, Sam Reck and others. You all have received the proceedings of that meeting, which will be a fine addition to your library. At this meeting the Association honored me with the office of President and elected Dick Peters as President-Elect and Fred Stutz as Vice-President. Dick in his official job as Program Chairman has made the arrangements for this meeting. He has done a wonderful job and the next few days will prove this. Fred Stutz has made a fine recorder. You all recall the minutes Fred made of the New Jersey meeting, which in itself is no small job.

At this point, I would like to comment on your hard working efficient secretary, Ted Raley. Without Ted our association would have a hard time operating. Lester Smith has done a swell job as treasurer. I think the $4,245.41 balance as of December 31st stands as a tribute to a job well done by Les.

Perhaps the most important function of our association is the publication of *Mosquito News,* and when you say *Mosquito News,* you can't help but think of Don Collins. Doc Bickley, who took over the advertising manager's job when Harry Stage left, has really come through with flying colors. He reports a revenue increase from advertising of approximately $800.00.

Barney Travis and Bo Hirst have been working hard on the publication of Bulletin No. 3 by Helen Louise Durkee, and it is now ready for distribution. Helen Sollers, a member of the Good Neighbor Club, reports $126.50 collected for subscriptions for foreign members.

In April, your President attended the meeting of the Florida Anti-Mosquito Association at Naples, Florida. This was an excellent meeting, presided over by Mel Williams. Under the leadership of John Mulrennan, sensational progress is being made in Florida.

On September 29–30 and October 1, under the sponsorship of the A.M.C.A., a seminar on Fogging and Misting was held at Toledo, Ohio. This meeting came about through the efforts of Otto McFeely, Dr. Brockway, Bruce Brockway and Bob Vannote. There were 107 delegates registered from 13 states and Canada. Great interest was shown in an area of the country where our association had not previously been too active. Thanks to the Toledo Sanitary District.

Your President has been a letter writer. It is estimated that approximately 2,000 pieces of mail went out from Norfolk. Ted Raley says this is good.

You will recall the letters to the membership enclosing a return card specifying the types of articles desired in *Mosquito News*. Out of 721 cards sent out, 147 were returned. The answers seemed to indicate a general approval with *Mosquito News* and desire for more operational articles.

Officers of the Association and Committee Chairmen were communicated with early in the year, setting forth their duties and what should be their goals. Perhaps the duties were not too well defined and perhaps the goals were too ambitious. At this point, I would like to commend Otto McFeely for the response he made to the goal set for his region. He was given a goal of 10 new members; 25 were signed up from the North Central Region. This was due to a large extent to the Toledo meeting. It is reported that they have a hot advertiser lined up. His goal in this department was 1 new account. His region has submitted an operation article for *Mosquito News,* which meets his quota. Twenty-five dollars was contributed to the Good Neighbor Club and assistance has been given to organizing the new South Cook District and to reviving the Illinois Mosquito Control Association. Most certainly, Otto has been a working director.

I think the above indicates briefly that progress has been made. It has been through your efforts that this has been possible, and I want to thank you all.

It might be well to state some of the things that I feel should be done in the future:

1. There is a need to rewrite the Constitution and Bylaws incorporating all of the amendments.
2. There is need to define and reorganize the Good Neighbor Club.
3. Consideration might be given to publication of special Bulletin No. 4 on Fogging and Misting.
4. A history of the association should be made, perhaps, by a special committee.
5. Encouragement should be made for more exchange of correspondence between the various officers.

ATTACHMENT #3

January 5, 1955

Board of Directors
American Mosquito Control Association, Inc.

Gentlemen:

In conformance with Article III, Section 2, Paragraph C, of the Bylaws of the American Mosquito Control Association, Inc., the undersigned members do respectfully petition that HAROLD FARNSWORTH GRAY, in recognition of his outstanding contributions to and distinguished service in the field of mosquito control, and in the face of his imminent retirement from normal mosquito control activities, be accorded Honorary Membership in the Association as provided: /S/ Richard F. Peters, John R. Walker, Edmond C. Loomis, Theodore Aarons, Benjamin Keh, Thomas D. Mulhern, Rowland E. Dorer, Lester W. Smith, Robert L. Vannote, Don M. Rees, C. R. Twinn, Fred H. Stutz, G. Edwin Washburn, Fred C. Bishopp, Otto McFeely, Samuel V. Minnich, Donald L. Collins and C. M. Gjullin.

ATTACHMENT #4

REPORT OF THE NOMINATING COMMITTEE OF THE A.M.C.A.

FOR 1955

The Nominating Committee for 1955 was appointed by the President and Board of Directors at the Atlantic City meeting in March 1954, and is representative of all 10 regions recognized by the Association as follows: Northeast Region, Mr. Geo. E. Powers; Central East Region, Mrs. Helen Louise (Trembley) Durkee; Southeast Region, Mr. Wm. C. McDuffie; North Central Region, Mr. Franklin C. Wray; Rocky Mountain Region, Mr. Leslie D. Beadle; Pacific Northwest, Dr. Gaines W. Eddy; Mexico, Central and South America and West Indies, Dr. H. P. S. Gillette; Canada, Prof. B. Hocking, Dr. F. C. Bishopp (Chairman).

To insure a completely democratic procedure, each member of the Nominating

Committee was requested by the Chairman to nominate one member of the Association for each office. The results of this canvass were then tabulated and distributed to the committee. Since none of the persons named received a majority, the members of the committee were requested to submit a second ballot naming for each office someone who was nominated for that office in the first ballot. The results of the second ballot were tabulated and distributed to the committee, together with a statement of the names of the members receiving a majority vote for each office. It was necessary to submit a third ballot to obtain a majority for the office of Vice President; also an additional ballot because of the declination of Mr. Otto McFeely who suggested the name of Mr. Charles F. Scheel as Director of the North Central Region. All the nominees have agreed to serve if elected. The list of nominees, together with the term of office, follows: President, Mr. R. F. Peters, 1 year; President Elect, Mr. Fred Stutz, 1 year; Vice President, Dr. A. W. Lindquist, 1 year; Executive Secretary, Mr. T. G. Raley, 2 years; Treasurer, Mr. L. W. Smith, 2 years; Regional Directors: Northeast Region, Mr. D. M. Jobbins, 2 years; Central East, Mr. D. MacCreary, 2 years; North Central, Mr. Chas. F. Scheel, 2 years; Pacific Southwest, Mr. G. E. Washburn, 2 years; Canada, Mr. A. W. A. Brown, 2 years.

The following elected officers of the Association have one more year to serve to complete their present terms of office as Regional Directors: Southeast, S. V. Minnich; Southwest (Gulf), Carl A. Nau; Rocky Mountain, Don M. Rees; Pacific Northwest, C. M. Gjullin; Mexico, Central and South America, Luis Vargas.

Fred C. Bishopp

ATTACHMENT #5

Treasurer's Report for the Period February 1 to December 31, 1954

RECEIPTS AND DEPOSITS:		
Bank balance, February 1st, 1954		$ 1,263.09
Dues and subscriptions	$4,027.48	
Advertising	2,853.93	
Reprints	435.59	
Good Neighbor Club Account	126.50	
Sale of Bulletin #1	14.56	
Sale of Bulletin #2	13.06	
Sale of back issues of *Mosquito News*	300.00	
Sale of special cut, Kil-Jet	2.12	
Sale of membership mailing lists	1.60	
Bank refunds and discounts	.67	
Registrations, Joint Meeting, Atlantic City, 1954	1,062.75	
Sale of exhibit space, Joint Meeting, Atlantic City, 1954	1,050.00	
Total Receipts		9,888.26
Total receipts and deposits		$11,151.35
DISBURSEMENTS:		
Printing and Reprints	$ 5,021.19	
Office supplies	229.35	
Postage	586.10	
Insurance and bonds	23.75	
Miscellaneous *	1,045.55	
Total Disbursements		$ 6,905.94
Balance on hand December 31, 1954		$ 4,245.41

* Includes: Traveling expenses, $375.00; convention expenses, $575.80; audit, $50.00; stenographic services, $15.00; bulletins, $10.00; checks returned and redeposited in receipts above, $16.00; refunds, $3.75.

ATTACHMENT #6

A.M.C.A. BULLETIN #2

BALANCES

NOVEMBER 29, 1954

Balance in checkbook		$ 149.72
Balance in Savings account	$1,033.73	
Checks to be deposited	13.50	
		1,047.23
Amount due for books sold		49.00

Books on hand
Approx. 1,015

ATTACHMENT #7

January 5, 1955

American Mosquito Control Association
Parsonage Road
Metuchen, New Jersey

Gentlemen:

We have examined the records of Mr. Lester W. Smith, Metuchen, New Jersey, Treasurer of American Mosquito Control Association for the period from February 1, 1954, to December 31, 1954, and have prepared, without audit verification, the attached summary of his recorded cash receipts and disbursements. (Editor's note: The summary, being in agreement with the treasurer's report, Attachment 5, is not reprinted.)

Pursuant to engagement the examination was limited in its scope, the extent of which is set forth herewith.

All recorded receipts were found to have been properly deposited in bank. All cancelled checks drawn by the Treasurer were inspected by us, and were compared with entries appearing in his cash disbursements journal. Such disbursements were supported by vendors' invoices. Cash on deposit at December 31, 1954 was reconciled with the statement supplied by the bank, and was confirmed to us by letter from the institution.

The scope of our examination did not include verification of members' accounts for dues charged, collected, or unpaid during the above mentioned period; nor did it include confirmation of other revenues which accrued to the Association during the period under review. The Treasurer informed us that the total due to the Association as at December 31, 1954, for 1954 dues and subscriptions, was $255.00. Also, he stated that the aforesaid dues, together with cash on deposit at the close of the period in the amount of $4,245.41, constituted all of the assets of the Association in his custody at December 31, 1954. The records show that unpaid charges against the Association as of the above mentioned date totalled $97.62.

The Minutes of the Association were unavailable for review.

Invoices inspected by us indicate that the following described fidelity bonds should be in force. These bonds were not available for our inspection.

Person Covered	Date of Policy	Insuror	Policy No.	Amount of Bond
(1) Theodore G. Raley	7-1 -54	Hartford	N-2703711	$2,000.00
(2) Lester W. Smith Treasurer	1-21-54	Travelers	428211	3,000.00

(1) Premium $5.00; term not stated on invoice

(2) Premium $18.75; term 3 years.

Respectfully submitted,
NATHAN LIPMAN

ATTACHMENT #8

BUDGET ESTIMATE 1955

President:		
Postage and stationery	$ 50.00	
		$ 50.00
Secretary:		
Postage	$ 75.00	
Printing, stationery, forms	100.00	
Telephone, telegrams	15.00	
Other expense	20.00	
Travel expense, Annual Meetings	300.00	
		510.00
Treasurer:		
Postage	$ 50.00	
Printing, stationery, forms	75.00	
Telephone, telegrams	25.00	
Bonds, insurance	23.75	
Audit of books	50.00	
		223.75
Editor:		
Postage	$ 25.00	
Printing, stationery, forms	25.00	
Telephone, telegrams	25.00	
Mosquito News and Reprints, four issues	6300.00	
		6,375.00
Advertising Manager:		
Postage	$ 50.00	
Printing, stationery, forms	35.00	
Telephone, telegrams	25.00	
Other expense	10.00	
		120.00
Librarian:		
Postage	$ 50.00	
		50.00
Other Expense:		
Miscellaneous	$ 171.25	
		171.25
TOTAL ESTIMATED BUDGET		$7,500.00

ESTIMATED REVENUE, 1955

Dues and subscriptions, 900 at $5.00	$4,500.00
Advertising $550.00 per issue	2,200.00
Reprints 125.00 per issue	500.00
Sale of back issues of *Mosquito News*, Bulletins	300.00
Contributions	?
TOTAL ESTIMATED REVENUE	$7,500.00

Respectfully submitted,
LESTER W. SMITH, *Treasurer*

ATTACHMENT #9

REPORT OF THE COMMITTEE ON BYLAWS

Your Committee on Bylaws recommends the following amendments to the Bylaws of the American Mosquito Control Association as presented in *Mosquito News,* Volume 10, No. 4, December 1950, and amendments adopted by the Association at the 1954 convention as published in *Mosquito News,* Volume 14, No. 2, June 1954.

Article V. Officers of the Association

Section 1. The Board of Directors.

a. *Members of the Board.* The Board of Directors shall consist of one Regional Director for each of the ten regional areas, and eight Directors at large who shall be: (The change here is deleting the word "six" and adding the word "eight" Directors at large.)

(1) The Chairman of the Board and President of the Association.

(2) The President-Elect, who normally ascends to the office of President at the next election. (This item is new.)

(3) The Vice Chairman of the Board and Vice President of the Association. (Modified.)

(4) The Treasurer of the Association.

(5) The Executive Secretary of the Association.

(6) The Recording Secretary of the Association. (New office.)

(7, 8) Remain the same as 5, 6 in the published Bylaws.

b. *Terms of Office.* The terms for which the officers named shall be elected are:

(1) The Chairman of the Board and President of the Association, a one year term of office.

(2) The President-Elect, a one year term of office.

(3) The Vice Chairman of the Board and Vice President of the Association. a one year term of office. (Duties as Recording Secretary deleted.)

(4) The Treasurer of the Association, a two year term of office.

(5) The Executive Secretary of the Association, a two year term of office.

(6) The Recording Secretary of the Association, a two year term of office, and

(7) Remain same as (5) in published Bylaws.

Article VI. Powers and Duties of Officers

Section 1. Amendments 1954. President-elect.

Delete C which reads: "Shall be Chairman of Program Committee."

Section 2. Vice President.

Delete paragraphs 2 and 3 in published Bylaws which read as follows:

"The Vice President shall serve as Recording Secretary at general conventions in addition to his other duties. He shall be responsible for keeping the Minutes of the Association when assembled in general convention, and of such other meetings as may be held. He shall be responsible for keeping in order, and for compiling from time to time for information of the membership through publication in *Mosquito News,* reports of proceedings derived from such meetings, and from proceedings of the Board of Directors as carried on by correspondence.

"In case the Vice President may be required to perform the duties of President, he may delegate another member of the Board of Directors to act for him as Recording Secretary."

Section 3. Secretaries.

A. *Executive Secretary*

The Executive Secretary of the Association shall have the following duties:

a. As Executive Secretary, he shall be responsible for setting in motion and following through any plans approved by the Board of Directors for:

(1) Current activities

(2) For the further development of the Association, and

(3) For coordinating the objectives, policies, responsibilities and services of the Association.

b. As Secretary of the Corporation, he shall have custody of the seal, and shall execute with the Chairman of the Board (President of the Association) all legal documents of the Association and affix the seal thereto, and in this capacity shall use the title of Secretary of the Corporation.

c. As Secretary of the Association (delete "and Chairman of the Standing Committee on Membership"), he shall:

(1) (Stands as written.)
(2) (Stands as written.)
(3) (Stands as written.)
(4) (Stands as written.)
(5) (Delete.)

B. *Recording Secretary.*

The Recording Secretary shall be responsible for keeping the minutes of the Association when assembled in general convention, and of such other meetings as may be held. He shall be responsible for keeping in order, and for compiling from time to time for information of the membership through publication in *Mosquito News,* reports of proceedings derived from such meetings and from proceedings of the Board of Directors as carried on by correspondence.

Section 4. Treasurer.

Delete Item g which reads, "He shall be Chairman of the Finance Committee."

Section 6. Board of Directors.

Add Item O as follows: May appoint an Assistant Treasurer upon the recommendation of the Treasurer and may appoint other assistant officers if the demand for such is justified.

Article VII. Nomination of Officers

Section 4. The report of the Nominating Committee shall be presented at a preliminary business meeting of the Association and nominations from the floor shall be made at the same time. Voting for the candidates shall be held at the regular business meeting of the Association.

Article VIII. Convention and Election of Officers

Section 2.

a. Unless the candidates for offices to be filled by election at a convention are unanimously accepted, either together or singly, by the convention as presented by the Committee on Nominations, the election shall be by ballot. Balloting, if employed, shall be at the regular business meeting of the Association.

The Committee on Bylaws further recommends that the Bylaws be brought up to date and rewritten so that the wording of each section conforms to that of all other sections.

Respectfully submitted,

Committee on Bylaws

Dr. R. F. Darsie, Jr.
Miss Helen Sollers
Mr. T. G. Raley
Mr. Thomas H. Sperbeck
Mr. John A. Mulrennan
Dr. Bailey B. Pepper, *Chairman*

January 17, 1955

ATTACHMENT #10

Report of the Good Neighbor Club AMCA, for 1954

Many members of the AMCA have contributed to the Good Neighbor Club and unfortunately most of them must remain anonymous. We refer to the $51.50 collected, rather painlessly, during a social hour at the Annual Meeting in Atlantic City. To all of these anonymous contributors we want to extend our thanks.

The money got us off to a good start on the 25 annual subscriptions we send to foreign countries.

However, as this amount was insufficient, late in the summer we sent out about 70 letters to members asking for contributions to raise an additional $73.50 to complete the goal of $125.00. In response to the request, $75.00 arrived due to the generosity of the following members: William H. Arendt, Fred Stutz, F. C. Bishopp, H. H. Stage, Harold Gray, Richard F. Peters, Helen Sollers, Chemical Insecticide Corporation of New York, and the Desplaines Valley Mosquito Abatement District of Lyons, Illinois. All contributed $5.00 each, except Harry Stage and the Chemical Insecticide Corp., both of whom gave $10.00 each, and the Desplaines Valley Mosquito Abatement District, who contributed $25.00. The Committee is most grateful for all of these gifts.

But next year is not far from us and if we are to keep our 25 Good Neighbor subscriptions active, we must raise another $125.00. The Treasurer now has on hand $1.50 toward the 1956 subscriptions. This money was left over from the $75.00, as we only needed $73.50.

Just a word about the recipients of our subscriptions. They are most grateful for the good will of the AMCA. While most are financially unable to purchase subscriptions, some, regardless of their finances, cannot obtain dollars in their country.

For the purpose of partially underwriting Bulletin 3, the Good Neighbor Club, mostly through the efforts of Harry Stage, collected up to March 1954, the sum of $387.56. This amount, in the McLachlen Bank of Washington, is to be used to purchase copies of Bulletin 3 (as far as the money will go) upon release of the publication. Copies purchased with this money already have been ear-marked for certain individuals who have paid in advance and for the Good Neighbor Club recipients.

/S/ HELEN SOLLERS, *Member*

ATTACHMENT #11

A.M.C.A. SPECIAL COMMITTEE ON RESEARCH AND DEVELOPMENT REPORT FOR 1954–55

The 1953–54 report of this committee dwelt at length with the terms of reference and interpretation of duties of the committee. Again, it is reported with regret that it has been impossible for the committee to meet as a body, and that during the past nine months relatively little has been accomplished by correspondence. During the past eight months your Chairman and one committeeman have been associated. The present report is largely the views of these two individuals.

The 1953–54 report included several suggestions which were deemed worthy of consideration by your executive. Your committee is unaware that any action has been taken. These suggestions, namely: (1) establishment of a file in which the current activities and interests of AMCA members are listed and coordinated; (2) establishment of a roster of research and control projects; and (3) the establishment and maintenance of a list of species of medically important arthropods, which are reared in laboratories, considered by your present committee to be of value still. It is hoped that further consideration can be given to these proposals during the coming year.

Recently your committee has been in correspondence with Dr. E. W. Huffman at the Ohio State University. Dr. Huffman is collecting information on arthropod colonies being maintained in various centers in the United States and Canada. It appears that this compilation may fulfill the suggestion made by this committee. A note on the progress of this project will be submitted to *Mosquito News* at a later date.

Another suggestion in the last report concerned an annual review of a topic of interest to AMCA members. The annual meetings continue to offer the opportunity for the presentation of invitation papers and symposia which would fulfill this

need. It is gratifying to find that several symposia and a number of invitational papers are scheduled for the Los Angeles meetings.

Although recently there has been a curtailment in research activities relating to mosquitoes, both in the U. S. Public Health Service and in the U. S. Department of Agriculture, the work to be done remains. If we can assume, optimistically, that this curtailment is a temporary one, a need will exist for trained researchers. All members of the AMCA can do a service by encouraging promising students to enter the field of mosquito control and research or of research in the broader field of medical entomology.

Submitted by:

D. W. Jenkins
W. C. McDuffie
A. W. Morrill
E. A. Smith
A. S. West, *Chairman*

ATTACHMENT #12

Report of A.M.C.A. Publications Committee on Publication of *Mosquito News*

Extremely little activity is the essence of the report of the Publications Committee for the year 1954. The following three matters seem worthy of record:

1. Rowland E. Dorer, President of the American Mosquito Control Association, Inc., conducted a card survey of the Association membership inquiring into the desire of the membership with respect to the subject matter content of *Mosquito News*. Each individual was urged to mark "research and development" or "operations" or "political management" or "other specific interests." This survey netted the following replies:

Research and Development	48
Operations	22
Political Management	1
Research and Development and Operations	53
Research and Development and Political Management	None
Operations and Political Management	4
Research and Development, Operations and Political Management	19
Suggestions for Articles	50

President Dorer interpreted the above as an indication of the membership showing a "considerable interest in operation articles." The Committee, largely by silent concurrence with the opinion of the Chairman, seems to be satisfied with *Mosquito News* in its current form, this implying that its present composition would seem to conform to the results of the survey made.

2. On the basis of initiative taken by the Committee Chairman who also served as Program Chairman for the 1955 Conference through the office of President-Elect, recommendation was made to the Board of Directors that the following plan be utilized with respect to publication of the Proceedings and Papers of the Eleventh Annual A.M.C.A. Conference:

> All invitational papers and the papers and proceedings of the symposia will be printed in the Proceedings and papers of the 23rd (1955) Annual Conference of the California Mosquito Control Association, Inc., to be financed and published by the California Mosquito Control Association, Inc., as a joint publication of both Associations.
>
> Any member of the American Mosquito Control Association, Inc., may present and/or submit a paper for publication, provided that all submitted papers be 700 words or less as a prerequisite to publication, or that in lieu, abstracts of submitted papers, prepared by the author, may not exceed 700 words; however, publication of submitted papers within the California Proceedings and Papers is optional to the author.
>
> Copy of the Proceedings and Papers of the 23rd (1955) Annual Conference of the California Mosquito Control Association, Inc., held jointly with the Annual Conference of the American Mosquito Control Association, Inc., will be furnished each member of the American Mosquito Control Association, Inc.

This plan, presented to the Board of Directors as a motion, was duly passed by unanimous vote.

3. It is the opinion of the Committee that the Association is indeed fortunate to have Dr. Donald L. Collins as its Editor of *Mosquito News*. His clearly demonstrated proficiency and diligence in this important job entitle him to more than passive redesignation as Editor for the coming year. He should be resoundingly commended for his outstanding service and highly professional attainment.

RICHARD F. PETERS, *Chairman*
January 21, 1955.

ATTACHMENT #13

A.M.C.A. MEMBERSHIP COMMITTEE REPORT FOR 1954

Membership and subscriptions to *Mosquito News* reached a new high in 1954. The December issue of *Mosquito News* was mailed to 1111 accounts. This is in favorable contrast to the 1953 number which was mailed to only 1,038. In both instances more than one copy was sent to a few addresses but this would not change the total number of individuals and agencies receiving *Mosquito News* very much. A nice round figure of 1,100 is more than safe and there is every reason to believe this can be 1,200 in 1956. Even 1,300 is possible if each member will make just a feeble effort.

Records on new accounts have been adjusted to the annual meetings rather than the calendar year. Between February 1, 1954 through January 14, 1955 there were 156 new accounts added to the mailing list. An even 100 new members joined the Association and 56 subscriptions were ordered. Cancellations took their toll, 87 accounts, but were not unusual. This left a net gain of 69 which is gratifying. The challenge for 1955 is to reduce the cancellation figure from the usual to a near minus. A few accounts will be dropped due to circumstances beyond anyone's control but most accounts are lost because someone failed to do his part. An all out effort will be made this year to keep each region cancellation conscious. Please don't throw the material you receive on this subject in file 13.

Payment of dues also reached an all time high in 1954. The Treasurer's report for February 1 to December 31, 1954 shows $4,027.48 had been received. This represents payment for 906 accounts which added to the Exchange and Honorary accounts makes a total of 930 in good standing. Available records show 133 accounts on the mailing list still delinquent for 1954. Some of these may have been paid through the Treasurer's office since his last memo, and of course many will probably pay for both 1954 and 1955 when they receive a statement. Any discrepancy between the 1,063 shown in this paragraph and the 1,111 in the first paragraph is due to different periods of time.

A breakdown of the 1,111 accounts on December's mailing list shows:

Active Members	779
Mosquito News Subscriptions	283
Honorary Members	7
Good Neighbor Club	25
Exchange	17

From information received on the distribution of the 1954 joint proceedings, 270 *Mosquito News* accounts are outside the United States. Canada leads this list with 45, Venezuela is next with 19, Thailand receives 14, England 13, India 12. In all, *Mosquito News* is read in 73 countries as well as in the United States.

In the United States, California leads the list with 150, New Jersey is next with 105, New York 73, Florida 57, Illinois 50, Utah 39, Maryland 38, District of Columbia 36, Virginia 35. Forty-three states and the District of Columbia receive one or more copies of *Mosquito News*.

New accounts since February 1, 1954 have been processed as they were received. Unanimous approval by the Board of Directors is recommended for all requesting the classification of Active Member.

T. G. RALEY, *Chairman*

ATTACHMENT #14

Report of the Committee on Legislation

New legislation specifically relating to mosquito control problems has not been noted or called to the attention of the Committee on Legislation. Several legislative items during 1954 which are somewhat indirectly related to mosquito problems are of interest.

A bill before the Illinois State Legislature during 1953 which would have permitted any part of an established mosquito control district to secede from the control district caused some concern to mosquito control workers. Fortunately, as reported by Mr. Otto McFeeley, President of the Desplaines Valley Mosquito Abatement District, the bill died in committee.

There is a definite trend towards legislation in various states to license and regulate the work of pest control operators. Such legislation was put into effect in the State of Kansas about one year ago. Certain states now have regulations relating to pest control services, and others are considering such regulations.

The commercial pest control industry at this time is not highly active in work relating to mosquito control but no doubt will play a more prominent role in this field in the future. No study has been made of the kinds of legislation that have been adopted in various states. Rather complete information relating to this could, no doubt, be obtained from the Secretary of the National Pest Control Association if it would be of interest to mosquito workers.

Passage during 1954 of the Miller Pesticide Residue Amendment (H.R. 7125) to the Food, Drug and Cosmetic Act of 1938, although affecting mosquito control operators indirectly for the most part, is without doubt the most important legislation relating to pest control which appeared during 1954. This amendment establishes procedures for regulating pesticide residues in foods.

The long drawn out and costly hearings to establish tolerances for pesticidal residues in foods which were held in the past by the Federal Security Agency, and the subsequent delays in setting tolerances were recognized by all concerned as being impractical under modern conditions of insecticide development and use. The Miller amendment which outlines specific procedures for establishing tolerances, with specified time limitations to establish such tolerances, apparently received the support of the Department of Health, Education and Welfare, the U. S. Department of Agriculture, and other governmental agencies which have major responsibility in enforcing the amendment. The bill also met the approval of the pesticide industry, agricultural experiment stations and other agencies. This is a good example of legislation which was developed through the cooperative efforts of various segments of industry and the governmental and state agencies directly concerned.

The Department of Health, Education, and Welfare published proposed tolerances for certain pesticides in the October 20, 1954, issue of the Federal Register. The tolerances on a wide variety of pesticides on fresh fruits and vegetables were proposed after several years' delay after hearings were held. It should be emphasized that the tolerances as published were proposals only, and based on toxicity information available in 1950.

The tolerances when finally established will probably not have a great effect on mosquito control programs since mosquito control in situations where fruits and vegetables might become contaminated fortunately represent only a small fraction of the overall operations. However, mosquito control agencies are often faced with delicate operations under circumstances where foods might become contaminated with the chemicals employed. The establishment of tolerances (or exemption from tolerances in the case of pyrethrins, and certain other compounds) should make it possible to select insecticides which can be employed without exceeding tolerances.

Fortunately the per acre dosages employed for effective mosquito control are often considerably lower than those employed for the same insecticide which necessitate direct application to food crops.

The report as submitted is based in part on information supplied by committee members. The report, however, has not been submitted for review to members. Therefore, it cannot be regarded as an approved committee report unless it has the concurrence of the required number of other committee members.

/S/ E. F. KNIPLING, *Chairman*
Committee on Legislation,
American Mosquito
Control Association

Other Committee members:

MR. OTTO MCFEELY
MR. P. B. BROCKWAY, JR.
MR. JOHN A. MULRENNAN
MR. HERBERT KNUTSON
MR. C. T. WILLIAMSON

January 20, 1955

ATTACHMENT #15

REPORT ON ADVERTISING IN *Mosquito News*, JANUARY 1, 1954 TO DECEMBER 31, 1954

The figures below represent transactions during the calendar year 1954 for advertising in four numbers, Vol. 13, No. 4, and Vol. 14, Nos. 1, 2, and 3 (December, 1953 and March, June, and September, 1954).

Number of active accounts	32
Number of pages of advertising (exclusive of A.M.C.A. business)	67¼
Receipts	$2,853.93
Expenses:	
Postage, telephone, telegrams	50.00
Printing, rate sheets, envelopes	33.00
Honoraria for stenographer, 1953 and 1954	15.00
Total Expenses	$98.00

Respectfully submitted

/S/ WM. E. BICKLEY,
Advertising Manager

Members of Standing Committee on Sales of Advertising Space:

R. L. VANNOTE
GEO. E. POWERS
SAMUEL V. MINNICH
HERMAN FELLTON
A. W. LINDQUIST
F. C. WRAY
P. B. BROCKWAY, JR.
LEROY KINSEY
WM. E. BICKLEY, *Chairman*

ATTACHMENT #16

MOTION PERTAINING TO PUBLICATION OF PAPERS TO BE PRESENTED AT JANUARY 24–27, 1955 JOINT MEETING OF THE AMERICAN AND CALIFORNIA MOSQUITO CONTROL ASSOCIATIONS

It is moved by Richard F. Peters, President-Elect, and seconded by G. Edwin Washburn, Director, Pacific Southwest Region, that the Board of Directors accept the plan proposed by the California Mosquito Control Association, Inc., for the January 24–27, 1955 joint meeting of the California Association with the American Mosquito Control Association, Inc., in regard to publication of papers presented during this conference. The following points are understood to be included within the plan:

1. All *invitational* papers and the papers and proceedings of the *symposia* will be printed in the Proceedings and Papers of the 23rd (1955) Annual Conference of the California Mosquito Control Association, Inc., to be financed and published by the California Mosquito Control Association, Inc., as a joint publication of both Associations.

2. Any member of the American Mosquito Control Association, Inc., may present and/or submit a paper for publication, provided that all *submitted* papers be 700 words or less as a prerequisite to publication, or that in lieu, abstracts of submitted papers, prepared by the author, may not exceed 700 words; however, publication of sub-

mitted papers within the California Proceedings and Papers is optional to the author.

3. Copy of the Proceedings and Papers of the 23rd (1955) Annual Conference of the California Mosquito Control Association, Inc., held jointly with the Annual Conference of the American Mosquito Control Association, Inc., will be furnished each member of the American Mosquito Control Association, Inc.

AMERICAN MOSQUITO CONTROL ASSOCIATION, INC.

DIRECTORS, OFFICERS AND COMMITTEES FOR 1954

Editorial Staff of *Mosquito News*—See inside front cover
Board of Directors and Officers—See back cover

Standing Committee on Publication of *Mosquito News*: C. R. Twinn, Chairman, Entomology Division, Agric. Dept., Science Service Building, Ottawa, Ontario, Canada; W. E. Bickley, Department of Entomology, University of Maryland, College Park, Maryland; Samuel V. Minnich, Box 4096, South Daytona, Florida; Don M. Rees, Department of Entomology, University of Utah, Salt Lake City, Utah; Cdr. John M. Hirst, U. S. Naval Air Station, Alameda, California.

Standing Committee on Legislation: John A. Mulrennan, Chairman, Director, Bureau of Entomology, Florida State Board of Health, Jacksonville 1, Florida; Otto McFeely, Desplaines Valley Mosq. Abate. Dist., 8130 Ogden Avenue, Lyons, Illinois; Arthur F. Geib, Kern Mosquito Abatement Dist., P. O. Box 907, Bakersfield, California; Lester W. Smith, Middlesex Co. Mosq. Exterm. Comm., Parsonage Road, Metuchen, New Jersey; George A. Thompson, Jefferson County Mosq. Control Dist., P. O. Box 194, Nederland, Texas.

Standing Committee on Research and Development: Maurice W. Provost, Chairman, Entomological Research Center, P. O. Box 308, Vero Beach, Florida; Allen S. West, Dept. of Biology, Queen's University, Kingston, Ont., Canada; Austin W. Morrill, Jr., San. Eng. Br., E.R.D.L., Ft. Belvoir, Virginia; Lt. Cdr. Kenneth L. Knight, USN, Div. Prev. Med., Bur. of Med. & Surg., Department of Navy, Washington 25, D. C.; Kenneth D. Quarterman, U. S. Public Health Service, P. O. Box 192, Savannah Beach, Georgia.

Standing Committee on Finance: A. W. Lindquist, Chairman, U.S.D.A. Plant Industry Station, Beltsville, Maryland; P. Bruce Brockway, Jr., Toledo Area Sanitary District, 5015 Stickney Avenue, Toledo, Ohio; Austin W. Morrill, Jr., San. Eng. Br., E.R.D.L., Ft. Belvoir, Virginia; Kenneth L. Knight, Lt. Cdr., USN, Div. Prev. Med., Bur. Med. & Surg., Department of Navy, Washington 25, D. C.; George E. Powers, Union Co. Mosq. Exterm. Comm., 324 North Avenue East, Cranford, New Jersey; Wm. E. Bickley, Department of Entomology, University of Maryland, College Park, Maryland; Lester W. Smith, Ex Officio, Middlesex Co. Mosq. Ext. Comm., Parsonage Road, Metuchen, New Jersey.

Standing Committee on Sales of Advertising Space: Franklin C. Wray, Desplaines Valley Mosq. Abate. Dist., 8130 Ogden Avenue, Lyons, Illinois; George E. Powers, Union Co. Mosq. Exterm. Comm., 324 North Avenue East, Cranford, New Jersey; Samuel V. Minnich, Box 4096, South Daytona Beach, Florida; Arthur F.

Geib, Kern Mosquito Abatement District, P. O. Box 907, Bakersfield, California; P. Bruce Brockway, Jr., Toledo Area Sanitary District, 5015 Stickney Avenue, Toledo, Ohio; Kenneth L. Knight, Lt. Cdr. USN, Div. Prev. Med., Bur. Med. & Surg., Department of Navy, Washington 25, D. C.; Wm. C. McDuffie, U.S.D.A. Plant Industry Station, Beltsville, Maryland; Wm. S. Murray, Public Works Office, Fifth Naval District, Norfolk, Virginia.

Standing Committee on Bylaws: Bailey B. Pepper, Chairman, Department of Entomology, Agricultural Experiment Station, New Brunswick, New Jersey; Rowland E. Dorer, Virginia State Dept. of Health, 301 Essex Building, Norfolk, Virginia; Ted G. Raley, Consolidated Mosquito Abatement Dist., P. O. Box 278, Selma, California; Robert L. Vannote, 3 Franklin Place, Morris Plains, New Jersey.

Standing Committee on Public Relations: Ernestine B. Thurman, Chairman, Department of Entomology, University of Maryland, College Park, Maryland; George E. Powers, 324 North Avenue East, Cranford New Jersey; John E. Porter, U. S. Quarantine Station, P. O. Box 1246, Miami Beach, Florida; Rowland E. Dorer, 301 Essex Building, Norfolk, Virginia; Richard B. Eads, State Department of Health, Austin, Texas; Donald R. Johnson, Div. of International Health, PHS, Health, Education & Welfare, Washington 25, D. C.; Robert H. Peters, No. San Joaquin Co. Mosq. Abate. Dist., 404 W. Pine Street, Lodi, California; Francis P. Creadon, 194 Addison Road, Riverside, Illinois.

Good Neighbor Club Committee: Archie D. Hess, Chairman, Public Health Service, P. O. Box 334, Logan, Utah; Robert L. Vannote, 3 Franklin Place, Morris Plains, New Jersey; Helen Sollers, Plant Pest Control Br., Agricultural Research Serv., Washington 25, D. C.; Rowland E. Dorer, 300 Essex Building, Norfolk, Virginia; John M. Henderson, Technical Development Lab., Communicable Disease Center, P. O. Box 769, Savannah, Georgia; Gordon E. Smith, Tennessee Valley Authority, Wilson Dam, Alabama; George A. Thompson, Jr., Jefferson Co. Mosq. Control Comm., P. O. Box 194, Nederland, Texas; Wm. J. Buchanan, South Cook Co. Mosq. Abate. Dist., 12217 South Harlem Avenue, Palos Heights, Illinois; Milton H. Buehler, City-County Health Dept., Eugene, Oregon; A. W. Buzicky, State Div. of Plant Industry, St. Paul Campus, Univ. of Minn., 312 Coffey Hall, St. Paul 1, Minnesota; C. Donald Grant, San Mateo County Mosq. Abate. Dist., P. O. Box 1116, Burlingame, California.

Program Committee: Fred H. Stutz, Chairman.

Historical Committee: Harold F. Gray, Chairman, Box 3081, Woodleaf Star Route, Oroville, California; Robert Glasgow, 1013 Washington Avenue, Albany, New York; Thomas D. Mulhern, 5545 East Shields Avenue, Fresno California; Ted G. Raley, Consolidated Mosquito Abate. Dist., P. O. Box 278 Selma, California; Robert L. Vannote, 3 Franklin Place, Morris Plains, New Jersey.

Membership Committee: Thomas D. Mulhern, Chairman, Calif. State Dept. Public Health, 5545 East Shields Avenue, Fresno, California, and Regional Directors.

Standing Committee on Miscellaneous Publications: John M. Hirst, CDR MSC USN, Chairman, Insect Vector Control, U. S. Naval Air Station, Alameda, California; B. V. Travis, Cornell University, Ithaca, New York; A. W. Lindquist, U.S.D.A. Plant Industry Station, Beltsville, Maryland; Carroll Smith, U. S. Department of Agriculture, Orlando, Florida; Archie D. Hess, Logan Field Station, P. O. Box 334, Logan, Utah; Vernon Conant, Bergen Co. Mos. Ext. Comm., Hackensack,

New Jersey; P. Bruce Brockway, Jr., Toledo Area San. Dist., 5015 Stickney Avenue, Toledo, Ohio; M. H. Buehler, Mosquito Control Officer, Eugene, Oregon; Mrs. A. T. Candy, Box 511, Glen Ellyn, Illinois; Wm. M. Cox, Mosq. Cont. Prog., Galveston, Texas; John A. Mulrennan, Box 210, Jacksonville, Florida; Thomas D. Mulhern, 5545 E. Shields Avenue, Fresno, California; L. F. Wells, Mos. Cont. Prog., Greenbush, Massachusetts; L. W. Zeigler, Mosq. Cont. Div., Rockville Center, New York; R. W. Gies, Delaware Co. Mos. Ext. Comm., Media, Pennsylvania; Don M. Rees, University of Utah, Salt Lake City, Utah; C. T. Williamson, 16 Orowoc Avenue, Islip, New York.

Edward M. Becton

Edward Major Becton, Director of the Indian River County Mosquito Control District, passed away suddenly at his home in Vero Beach, Florida, on the morning of April 23, 1955, at the age of 51.

He was elected president of the Florida Anti-Mosquito Association this spring and was an active member of the American Mosquito Control Association. He attended the scientific meetings of the association and served on committees.

For many years Mr. Becton was associated in the development of a botanical garden in Vero Beach. He served as a member of the Board of Commissioners of the Mosquito Control District of Indian River County from 1941 until he resigned to take over as director of the district in 1950.

Mr. Becton was reared in Palmyra, New Jersey. After graduation from Palmyra High School, he attended Dartmouth College. He received his B.A. degree from the University of Kansas, and his M.S. degree from Ohio State University in 1930.

He was a civic leader in his community; a past president of the Vero Beach Rotary Club, a member of the Elks Lodge, and a member of Alpha Tau Omega fraternity. He worked hard and successfully to bring into realization state wide mosquito control in Florida. He was instrumental in procuring the passage of legislation for the establishment of an entomological laboratory for the study of mosquitoes and sand flies. This laboratory will soon be completed and is located in Indian River County.

The scientific background of Mr. Becton and his years of service on the board qualified him as one of Florida's most able directors. His counsel will be greatly missed, not only by his community but throughout the state.

He is survived by his wife, Mrs. Clara Mae Becton; a daughter, Barbara; a son, Edward; and a brother, George T. Becton of Riverton, N. J.

NEWS AND NOTES

HAROLD F. GRAY IS RECOVERING NICELY FROM A RATHER SERIOUS OPERATION ACCORDING TO DICK PETERS, A.M.C.A.'s 1955 proxy, who writes:

"The day of retirement barely came in time for Harold F. Gray. Although appearing to be in good health as reflected by his cheerfulness at the Annual Conference in Los Angeles, he actually was only scarcely a month away from a serious operation. A kidney infection resulted in Harold having to submit to a nephrectomy on March 3. The graveness of his condition was illustrated by the decision to operate, even though he had a low-grade fever at the time. Harold's post-operative period was complicated by a severe bout of hiccoughing which persisted over a week and inevitably drew upon his storehouse of strength. In fact, Harold describes the experience as a 'mighty close squeak.' Those of us who know Harold well attribute his recovery to his rugged determination and resolution to realize at least twenty years of fiscal return from his retirement. Others believe he made the grade on his cussedness alone. In any case, we are pleased to inform his many friends that Harold is now convalescing and recuperating in his retirement rancho, Box 3081, Woodleaf Star Route, Oroville, California. Of course the welcome sign hangs out."

MARVIN C. KRAMER, formerly manager of the Tulare Mosquito Abatement District, will depart soon to a new position as assistant to E. Chester Robinson who, as noted last month, is the new manager of the Alameda County District.

AL WEST, who has been on a year's assignment at Camp Detrick, Maryland, returned to Canada the latter part of April.

BEN KEH, reports in the April issue of *California Vector Views* that a gynandromorph mosquito was taken near Manteca, California, during an encephalitis virus recovery survey, by one of the workers of the Bureau of Vector Control. "This *Culex tarsalis* specimen," Ben reports, "has the genitalia of a male and, instead of the bushy antennae characteristic of a male, it has the more sparse and reduced antennae typical of the female. The palpi are short as in a normal female. A more detailed study of this specimen is contemplated in the near future. Gynandromorphs are quite rare. Their scarcity may be gauged from the small number of these freaks recorded from the millions of mosquitoes taken and examined by entomologists all over the world."

A FURTHER NOTE ON LIGHT TRAPS appears in the same journal and is of interest to control operators in connection with last month's discussion. During the period from 24 August through 23 October, 1953, three light traps were operated, one from 7 to 11 p.m., one from 11 p.m. to 3 a.m. and one from 3 to 7 a.m. On a number of occasions mosquitoes were seen resting on the illuminated surface of the adjacent building, neither active nor further attracted to the light. The smaller numbers of mosquitoes caught from 3 to 7 a.m. were not necessarily an indication of a reduction of mosquitoes in the area, this seems to indicate, and, in fact, on some mornings as many mosquitoes were seen resting in the immediate vicinity of the traps as had been caught in them.

FROM DON PLETSCH, A BELATED NOTE ON THE BAGUIO CONFERENCE comes via a letter which he sent to the American Society of Professional Biologists, and relayed by them to us. Don relates that some attention, though hardly enough to satisfy a fanatic in control, was paid to the problem of efficient application of insecticides in houses. "There seems to be a general impression," he says, "that all one must do is to place a sprayer in a laborer's hands and say, 'Now act like a spray-man' and he does so automatically.. This is far from true here in Formosa. I am increasingly suspicious that the instances of reported non-effectiveness of DDT may not be due so much to vector resistance or changes in vector habits as to sloppy spraying jobs during the field work." This seems worth thinking over in any part of the world where more and more careful application methods will be needed to counteract such resistance as may be appearing. Don adds that their program has given direct protection to 5½ million people during the 1954 operations.

H. BARNES, QUOTED IN THE ALAMEDA U. S. NAVAL AIR STATION'S THER-MAL AIR-O-SOL, asseverates that we should tell people our slogan in a punchy rhyme:

SO THERE YOU ARE
Slap a mosquito, trap a rat
Good idea, of course,
BUT
To most effectively combat
GIT-'EM at the source!.

A fellow who can split an infinitive so wide open at one blow ought not to have much trouble convincing folks he's man enough to tackle a mosquito.

THROUGH THE COURTESY OF BRUCE BROCKWAY JR., OF TOLEDO, a stenographic record of the case of Richard Calaway, *et al.*, vs. the United States of America, has been made available to us. This case covered the liability of the Government in obscuring a highway with a fog which was being created for mosquito control at the Erie Ordnance Depot. The fog drifted over the highway without warning, a truck entered the fog and immediately slowed down, whereupon a following passenger car struck it with such force that the car was demolished and the passengers injured.

The Court found that the driver of the car was not negligent, after the truck driver testified that he himself had not been able to see the fog until he had entered it and that the following car could not have seen it in time to have slowed down and avoided the collision. On the other hand, the Court cited a number of precedents where those who created obscuring smokes and fogs had previously been adjudged guilty of negligence. Damages were awarded both to the injured car passengers and to the insurance company which reimbursed the loss of the car.

This case is of interest to all those engaging in fogging operations since they are warned thereby to guard against negligence in obscuring highways. Everyone is aware of the danger which is created when children follow a fogger and dart in and out of the fog with a high likelihood of their being injured by passing cars. But not everyone thinks of the need to arrange police permission or warnings to motorists on nearby highways toward which the fog may blow.

From the Arctic Health Research Center in Anchorage, Alaska, Bill Froiine contributes a note on the occurrence of mermithid parasites in Alaskan mosquito larvae. The Jenkins & West article in Mosquito News 14(3) reports that the northern larva most frequently infested with mermithid worms is *Aedes communis* (DeG.), and that in the course of their studies in Canada they also found individual parasitized larvae of *A. nigripes* (Zett.) and *nearcticus* Dyar. In six seasons of larval surveys in Alaska, Bill has found mermithid parasites of *communis* wigglers three times: (1) In temporary potholes in a spruce bog at Liberty Falls near Chitina, June 3, 1953. (Unfortunately the wigglers from several of these potholes were combined and it is uncertain whether the *communis,* which were heavily infested, developed in the same water with *A. diantaeus* and *pionips* of the collection, which were all free of parasites.) (2) In a semipermanent, boggy pool below Herbert Glacier near Juneau, Alaska, June 6, 1952. Four species of *Aedes* larvae were dipped, of which three—*communis, cinereus* Mg., and *pionips* Dyar— were parasitized. The wigglers of the former two species, respectively 17 and 3, were all positive, usually with 2–3 worms coiled transversely in the thorax. *A. pionips,* a later mosquito, was mostly in the second instar and these small larvae appeared to be negative, but a single large third instar *pionips* had two mermithids. (This collection was rechecked recently to confirm the identifications and to corroborate the negative status of *A. hexodontus* Dyar, the fourth species present. An earlier larval collection of May 15, 1952 from the same pool, composed of second and third instar *communis* wigglers was re-examined along with four early June larval collections from neighboring ponds. All these larvae appeared to be negative.) (3) One mermithid in an *A. excrucians* (Wlk.) fourth stage larva collected May 19, 1954 was taken from a semipermanent *Carex* pond near Copper Center. Five other collections, all completely negative, had been made in 1953 in this pond including (of northern *Aedes* besides *excrucians*) *communis, fitchii, diantaeus, cataphylla, punctor,* and *stimulans.*

John A. Mulrennan, Director of the Bureau of Entomology of the Florida State Board of Health, has announced that the new entomological research center four miles south of Vero Beach in Florida's East Coast Indian River County is scheduled for completion in May.

"Although the new research center is located on the lower East Coast," Mulrennan explained, "it will be an 'All-Florida' project designed to serve all the state's insect control districts and projects.

"Its primary purpose will be the practical application of scientific knowledge to programs designed to kill as many mosquitoes and other insects of public health and economic importance as possible at the lowest reasonable cost.

"Although our knowledge of the habits of mosquitoes and other biting insects is fairly extensive, there are still a number of unanswered questions where good, economical control measures are concerned. It will be the responsibility of the new research center to determine the answers to these questions and to pass on the information to the state's mosquito control districts and various county health department projects in this field.

"We feel the contributions this new research center can make in effective control measures will speed the day when Florida will at least be relatively free of insects which offer a threat to the state's health and economic development."

The new center, a two-story concrete block structure, will contain offices, laboratories, special insect-breeding rooms, storage space for supplies and equipment and other facilities for entomological studies.

Dr. Maurice Provost will be in charge of the research center.

California Vector Views has in its March issue an interesting discussion of mosquito (and fly) source reduction with liquid manure systems, which should be of value even to those areas where dairying is not a big industry.

"A number of years ago," the report says, "the worst producers of house mosquitoes in the Delta Mosquito Abatement District were the sewage disposal plants of the various cities in the District. Through the active cooperation of the cities, the mosquito problems at sewage plants have been reduced to a very minor matter. Following the elimination of these major sources, dairy drains have emerged as one of the most important producers of house mosquitoes. Several very serious outbreaks this past summer have been traced directly to dairy drains. The impossibility of controlling these mosquito sources with insecticides means that, unless we can obtain changes in certain existing practices before next summer, we are likely to have a very troublesome year.

"Dairymen must wash their cows and their barns in order to produce the high quality, clean milk which we demand for ourselves and our children. This liquid manure, including necessary water for washing the cows and barn, amounts to about 22 gallons per day per cow." The report goes on to describe control of the problem by means of pumping the liquid into a septic tank or irrigation stand-pipe, from which it flows to fields for irrigation and fertilization rather than standing in swampy puddles under the manure-induced heavy vegetation, an ideal breeding source and one of the most difficult to control.

THE EURASIAN WATER-CHESTNUT or Water Caltrop, *Trapa natans,* is now re-established in the upper Chesapeake Bay. Francis M. Uhler of the U. S. Fish and Wildlife Service has reported that four separate beds totalling about 100 acres in the Gunpowder River Area were observed in 1954. A rapid increase in the infestation can be expected unless prompt action toward eradication is taken.

Navigation, aquatic wildlife, and recreation in the fresh-water section of the Bay are threatened. The floating plants choke shallow areas and provide ideal conditions for mosquito breeding. The nuts produced by Caltrop are spined and prevent the use of beaches by swimmers.

The infestation in the Potomac lasted for about twenty-five years and was controlled by underwater mowers operated by the Army Corps of Engineers. Over $500,000 was spent for cutting, and mosquito control by the Public Health Service was also very expensive. Mr. Uhler has stated that the infestation if uncontrolled is certain to be a major disaster. This is no exaggeration.—William E. Bickley

THE ILLINOIS MOSQUITO CONTROL ASSOCIATION, dormant since 1951, was re-activated on February 23 and 24, 1955, with a meeting at the University of Illinois, in Urbana. Representatives were present from eight of the eleven active districts in the state, as well as from community mosquito control groups, state and local health departments, the State Department of Conservation, the Natural History Survey, the University Department of Entomology, the Agricultural Experimental Station, and several commercial concerns.

An informal refresher course in mosquito classification was held Wednesday morning under the direction of the Department of Entomology with an overflow attendance.

The program included a series of papers on the general subject of Standardization and Evaluation of Mosquito Control Operations. Those participating included Mr. C. F. Scheel, North Central Regional Director of the A.M.C.A.; Franklin C. Wray, Des Plaines Valley District; Dr. William R. Horsfall, Professor of Entomology, University of Illinois; Oscar V. Lopp, South Cook County District; and Dr. F. Earle Lyman, Associate Professor, Southern Illinois University.

Papers were also presented on the "Distribution of Mosquitoes in Illinois" by Dr. H. H. Ross, and on "Insecticides for Mosquito Control and Resistance to Insecticides" by Willis N. Bruce, both of whom are in the Natural History Survey.

At the business session, presided over by Thomas J. Lynch of the North Shore District, the following officers were elected to constitute the Executive Committee for 1955:

President	Franklin C. Wray
Vice-President	Ralph K. Gibson
Secretary-Treasurer	James D. Williams
Members-at-Large	Thomas J. Lynch
	William J. Buchanan
	George N. Willard

Tours were also made through the University Department of Entomology and the Illinois Natural History Survey.

FRED H. STUTZ SENDS IN A NOTICE FROM THE BRAZORIA COUNTY, TEXAS, CHAMBER OF COMMERCE THAT AN ORGANIZED MOSQUITO CONTROL PROGRAM is being set up in that county. A clipping from the *Daily Facts-Review,* which they sent Fred in thanks for his advice and assistance, starts off, "Brazoria County voters approved by more than two to one the setting up of a mosquito control district in the county." The story continues with a discussion of the background of the movement and states that the Brazoria County Commissioners Court will now appoint a five-man board as governing body of the new district, which will hire a general manager and entomologist to run the program. Voters in all but one district were strongly in favor of the proposal and of setting up a levy of 5 cents per $100 valuation tax to finance the mosquito program.

THREE MORE ITEMS FROM CALIFORNIA which are of general interest: The summary of registrations at the joint meetings of the A.M.C.A. and the California M.C.A., at Los Angeles, shows that 169 of the registrants were from California, most of them from mosquito abatement districts, while 85 were from other states, Canada, the Rockefeller Foundation, the Pan American Bureau and various agencies of the Federal Government and the Armed Services.

From 22 to 25 June, 1955, the 39th Annual meeting of the Pacific Slope Branch of the Entomological Society of America will be held at the Mission Inn in Riverside. The program will contain invitational papers of subjects of current importance, submitted papers, movies and assorted entertainments.

Alameda County reports that they filled 1,282 tree holes with cement and sand this year to prevent breeding of *Aedes varipalpus,* which had been found in 201 of the holes. This is an aspect of pest mosquito control which is overlooked in the mosquito control of many localities, for a few hole-breeders can make the whole program seem ineffective.

AMONG OUR WHO'S WHO IN A.M.C.A. we had hoped to bring you in this issue all the dope about our 1955 prexy, Dick Peters. Dick, how-

ever, in his modest way didn't put anything on his form but his address, so while we are waiting for our threatening letters to bear fruit, a quick search of the file shows that A.M.C.A. has more than enough notables to fill even the gap made by Dick's absence.

Our first notable was born on a ranch at Virginia Dale, Colorado, in January 1884 and received his B.S. and M.S. at Colorado Aggie, moving on for a Ph.D. at Ohio State. He taught at the University of Maryland before going to the U. S. Department of Agriculture, where he served with distinction as an entomologist, rising to head the Division of Insects Affecting Man and Animals and to become Assistant Chief of the Bureau of Entomology and Plant Quarantine. Under his guidance much of the military program was staffed during the war and research was done on materials and techniques of military importance. He is a member of various scientific societies, and has been president of the Washington Entomological Society, the American Association of Economic Entomologists, the American Society of Parasitology and our own Association. He is now coordinator of Pink Boll Worm Research at the Oscar Johnston Cotton Foundation, Brownsville, Texas, but retains an active interest in mosquito control. DR. FRED C. BISHOPP, that is, of course.

EDWARD F. KNIPLING, who followed Dr. Bishopp in many of his footsteps, including chiefship of the Division of Insects Affecting Man and Animals of the Bureau, and who has been President of the American Association of Economic Entomologists and is now Chief of the Entomological Research Branch of the Agricultural Research Service of the U. S. Department of Agriculture, was born in March of 1909 at Port Lavaca, Texas, and raised on a farm. His undergraduate work was done at Texas A. and M. and he received his Masters Degree and Ph.D. at Iowa State College. He headed the laboratory at Orlando, Florida, during the war, at which time the use of DDT was developed and repellents 612, 622 and others were originated there. This laboratory, which consisted of a good-sized group of high-powered specialists, turned out findings at such a rate that the Armed Services were put to it to apply their findings and industry had difficulty keeping up production, but they worked modestly and without fanfare and much of the resulting publicity passed them by. Although Knip has received numerous medals and citations and is well-known for his work on cattle grubs and horn flies as well as mosquitoes, he is quietly proudest, perhaps, of his prowess as a hunter with bow and arrow. Three deer have fallen to his arrow in recent years but he says he won't reveal how many got away "because of 'Buck Fever.'"

A. W. A. BROWN, who manages to be known to a large number of people as "Tony" in spite of his awesome erudition, was born in 1911 in England. He received his B.S. in 1933 from the University of Toronto and went on to his M.A. and Ph.D. in 1935 and 1936. He is author of two books: "Insect Control by Chemicals," in 1951, and "Entomology: Medical and Veterinary," in 1954. By way of accomplishments, part of the list includes the Canadian Forest Insect Survey, a military Majority in the Directorate of Chemical Warfare, now the Defence Research Board of Canada, of which he is still a member of the entomological panel, the National Research Council panel on Vectors of Disease, the WHO Expert Committee on Insecticides, and the Executive Committee of the Xth International Congress of Entomology. He has been chief of the Department of Zoology of the University of Western Ontario since 1947, is a member of the Royal Society of Canada, the editorial board of the Annual Review of Entomology and the Entomological Societies of Ontario and of Canada. As a crowning achievement, naturally, he is the Regional Director of A.M.C.A.

YOUR NEWS AND NOTES EDITOR claims no eminence but it's a good thing he gets around pretty well all over, because WILLIAM C. REEVES is another A.M.C.A. notable who modestly left off half his accomplishments. Fortunately, the facts were known and we just want the facts, ma'am. Bill is a Californian who received his Ph.D. from the University of that State, where he first entered mosquito control activities in 1938. With the Hooper Foundation and the University of California School of Public Health, where he is now a professor, Bill has been doing research in tropical medicine, epidemiology and insect transmission of disease ever since. In 1947 he was instrumental in pinpointing an epidemic of what appeared to be encephalitis in Guam and which had the local control people, who had previously been sort of ignored, in a feverish blaze of activity and unwonted attention. He supervised an intensive survey on the part of military and civilian agencies and uncovered the presence of the first anopheline on Guam, *Anopheles subpictus,* and of a new dengue-carrier, *Aedes albopictus,* both presumably introduced since the war. Through his supporting testimony, the Navy program of control was considerably augmented and the Army and Air Force established control sections and set up a permanent position for an entomologist. Bill has acted as consultant to the Surgeons General of the Public Health Service and the U. S. Army, and in 1954 toured Army installations where his practical recommendations were widely acclaimed for their helpfulness and the sound understanding they displayed of the problems confronting them.

GOOD NEWS HAS BEEN RECEIVED FROM PRESIDENT CARL A. NAU OF THE GALVESTON COUNTY, TEXAS, Mosquito Control Association. He states that the County Judge has found an additional $12,500, thus providing $40,000 for the initiation of the newly organized anti-mosquito work in

Galveston County. Bill Cox has been appointed Director of Mosquito Control and Dr. Don Micks as Technical Consultant.

It will be recalled that the Galveston County Mosquito Control Association was organized on July 29, 1953 (Mosquito News 13(3):216), and that the voters approved the establishment of a Mosquito Control District at an election held November 7, 1953 (Mosquito News 13(4):264). Delay in providing funds to start the work was due to the fact that the County was levying the maximum permissible tax in the general fund.

Dr. Nau states that neighboring counties are "looking across the fence" and that the favorable action in Galveston County may cause them to move in the same direction. Dr. Nau writes on May 17 that the Judge of Orange County has called a meeting of representatives of all Texas coastal counties in Orange on May 18 and that four from Galveston are going to attend.

This forward movement along the Texas coast is definitely favorable for the forthcoming meeting of the AMCA in Beaumont on February 5–8.—F. C. Bishopp.

ORANGE, TEXAS. F. J. VON ZUBEN, JR., Senior Sanitary Engineer, Texas State Department of Health, has sent the following information on the meeting in Orange, Texas, on May 18, 1955. (See above note from Dr. Bishopp.)

"The Honorable Charlie Grooms, County Judge of Orange County, called a meeting of officials of Texas Gulf Coast Counties to discuss the mosquito problems common to that area of the State. Approximately 40 interested officials were in attendance from Orange, Jefferson, Chambers, Galveston and Brazoria Counties. Among the more important officials were the following: Charlie Grooms, County Judge of Orange County; James A. Kirkland, County Judge of Jefferson County; F. E. Williams, County Judge of Chambers County; Alton C. Arnold, County Judge of Brazoria County; Carl A. Nau, M. D., Chairman, Galveston County Mosquito Control Assn.; Paul R. Meyer, M.D., Chairman, Jefferson County Mosquito Control Assn.; P. J. Gurklis, Chairman, Health and Sanitation Committee, Brazoria County Chamber of Commerce; (also a representative of Dow Chemical Company of Freeport); and H. H. Key, M.D., Director, Orange County Health Unit, Orange, Texas.

"After an address of welcome and a few introductory remarks, Judge Grooms turned the meeting over to me. I suggested that consideration be given to the formation of Texas Gulf Coast Mosquito Control Association, pointing out that this would be an excellent means of exchanging technical information, as well as accomplishing other desired objectives. After some discussion, the motion was made and favorably voted on by those present. Jefferson County Judge Kirkland was elected temporary chairman, and Orange County Judge Grooms was elected temporary secretary. A committee consisting of the five interested county judges was appointed to work up rules and regulations governing the activities of the Association. Judge Arnold, Brazoria County, invited the Association to hold its next meeting in Brazoria County. This was approved, and it was agreed that Judge Kirkland would set the date for the next meeting and notify all concerned.

"Next, the pressing problem of enabling State legislation was thrown open for discussion. It was the general consensus of opinion that old H.B. 127 was grossly inadequate, and that a constitutional amendment would be needed before the counties could adequately finance effective control programs. Those present instructed the Association officers and committee of county judges to support the passage of a constitutional amendment in the current session of the Legislature.

"There seemed to be considerable enthusiasm concerning the formation of the Association, and all present seemed to feel that it was a step in the proper direction. It was felt that this Association could form the nucleus of a larger State Association when additional counties become interested in other sections of the State."

REVIEWS AND ABSTRACTS

Mosquitoes. Their Bionomics and Relation to Disease. By William R. Horsfall. viii+723 pp. Ronald Press Co., New York 10, 1955. Price $16.00. Dr. Horsfall, who has previously made a number of valuable contributions to our knowledge of mosquitoes, has now produced a monumental piece of work summarizing the bionomics and disease relationships of the mosquitoes of the world. The author's index indicates that 2,079 species or subspecies are referred to in the text.

The subfamily Culicinae is first discussed in a general way, bringing out important facts on distribution, habits and physiology applicable to the whole group. Parasites and predators attacking mosquitoes are tabulated. A table is also presented listing the species of mosquitoes that are reported to show resistance to various insecticides, where this occurs and by whom reported. Relations of mosquitoes to various virus diseases including yellow fever, dengue, and encephalitides are also given in tabular form.

More detailed information is then presented by genus and species following the same plan used in the subfamily discussion. Especially useful are the tables showing relation between the mosquito species and *Plasmodia,* local larval distribution, and host relations of the more important species. The summary statements on the breeding, flight and other habits, and the seasonal history, longevity and toxinosis, arranged by species, makes readily available much information in concise form.

Obviously little information is published on many of the species listed but the author has done a remarkable job in assembling the major part of that which is available. Work on species that have been thoroughly studied, and these are mainly the ones of greatest economic importance, is well reviewed. The extent of this review is indicated by the bibliographical references which total 4215.

In an appendix are given citations to techniques used by various workers and a glossary of technical terms.

Although rather expensive, this book is so useful to people conducting research on mosquitoes in any part of the world that they can not well be without it. It should also prove valuable as a reference work in libraries of large mosquito control organizations.—F. C. Bishopp, P.O. Box 1033, Brownsville, Texas.

The Black Flies (Diptera, Simuliidae) of Guatemala and Their Role as Vectors of Onchocerciasis. By Herbert T. Dalmat. Smithsonian Miscellaneous Collections 125(1):vii–425 pp., 44 pls., 36 tables, 21 figs., 15 maps. Published by the Smithsonian Institution (Publication 4173), April 5, 1955. Onchocerciasis, a disease which is transmitted by blackflies, is of considerable economic importance in Guatemala. It is endemic along the western foothills of the Sierra Madre Mountains in an area of about 500 square miles, and in two smaller areas, aggregating about 85 square miles, near the Mexican border. In the endemic zones, about 35 per cent of the population is infected. Ocular involvement is manifest in more than half of the persons infected, and blindness occurs in approximately 5 per cent.

A large number of factors—economic, social, topographical, climatological, and entomological—influence the distribution and prevalence of the disease. In the first part of this volume, the epidemiology of onchocerciasis is discussed in a search for the explanation of its limited distribution in Guatemala. The geography, climate, customs and occupations of the inhabitants, plant and animal associations (with particular reference to *Simulium* species), and the types of streams inside and outside of the endemic areas are considered.

When this study was initiated the taxonomy of the Guatemalan species was incompletely known. Certain species of *Simulium* had been incriminated as vectors of onchocerciasis in Guatemala, but many details of their life history and ecology were lacking. One of the important phases of Dr. Dalmat's investigation was the collection and classification of species of blackflies occurring in Guatemala. Ten new records and 13 new species were reported by the author in the course of this study. Complete descriptions and keys to genera, subgenera, and species of males, females, pupae, and larvae of the Guatemalan species are given.

Only 6 of the 41 species of blackflies found in Guatemala commonly bite man, the others being almost entirely zoophilic. In the principal onchocerciasis zone, the three important anthropophilic species are *Simulium ochraceum, S. metallicum* and *S. callidum.* An excellent account of the life histories of these species is given along with less detailed life histories of some of the other species.

Studies of the biting habits, flight range, longevity (of both infected and non-infected flies), resting places and heights at which the adults occur were made. Attempts to establish a laboratory colony of blackflies, although unsuccessful, were ingeniously contrived and provide some very interesting information. There is a section dealing with the factors influencing the distribution of the immature stages in streams. Altitude, stream temperature, pH, size of the stream and rate of flow along with other factors are considered in relation to stream types and to species of blackflies occurring in the streams.

The seasonal population fluctuations of the different stages of the principal anthropophilic

species are discussed in relation to the timing of control measures for optimum effectiveness.

At the end of the book there is a section entitled "Transmission of Human Onchocerciasis in Guatemala," in which the author discusses onchocerciasis in Guatamala and how its distribution is affected by the habits and habitat preferences of the blackflies which transmit the disease.

This study by Dr. Dalmat is an outstanding contribution to our knowledge of Guatemalan blackflies in relation to onchocerciasis.—H. Jamnback.

THE MECHANISM OF FOOD DISTRIBUTION TO MIDGUT OR DIVERTICULA IN THE MOSQUITO. M. F. Day. Australian J. Biol. Sci. 7(4):515–524. 1954. This paper is concerned with explaining what factors permit adult *Aedes* mosquitoes to shunt blood into the midgut and sugar solutions into the ventral diverticulatum (crop) as described by Fisk, Trembley, and others. When both blood and sugar are imbibed by mosquitoes the mixture goes to both midgut and diverticulum. The *Aedes* female is able to detect 1 part blood in 20 of glucose. Although *Aedes* detect sucrose, arabinose, mannose, and raffinose, they are apparently unable to detect lactose.

The author describes and figures four types of papillar sense organs within the "buccal" cavity: (a) three pairs of "palatal" spines, (b) a dorsal papillar sense organ, (c) three dorsal pairs of hair-like receptors, and (d) a single pair of campaniform papillae. While all seven pairs of sense organs receive nerves from the frontal ganglion, the precise method of their innervation was not traced. Innervation of the diverticula via the stomatogastric nerves is diagrammatically illustrated.

The following hypothesis is suggested: "certain sugars stimulate the pit organs in the buccal cavity . . ., causing impulses that result in the relaxation of the sphincters of the diverticula. Certain components of the blood of vertebrates stimulate the papillae sense organs, resulting in relaxation of the cardiac sphincters. Simultaneous stimulation of both groups of sense organs may result in relaxation of both series of sphincters." (p. 522.)

This hypothesis seems to be a very reasonable one. It would be extremely interesting to test its validity by ablation or stimulation of the frontal ganglion under different conditions. Presumably the frontal ganglion is the principal relay station for the switching mechanism. Before such experiments could be performed one would need much more detailed anatomical information.—Jack Colvard Jones, National Institutes of Health, Bethesda 14, Md.

NEW DATA ON THE PHYSIOLOGY AND ANATOMY OF THE DIPTERAN HEART (STRUCTURE AND FUNCTIONS OF THE HEART OF *Anopheles maculipennis* MGN.). By L. V. Iaguzhinskaia. Biull. M. Ø-VA Isp. Priordy, Otd. Biol. 59 (1):41–50. 1954. (In Russian.) This paper briefly describes the anatomy of the abdominal part of the heart in adult *Anopheles maculipennis* after staining whole mounts with methylene blue. It refers to the spiral musculature of the heart tube, to ostia, alary fibrils, large pericardial cells, and to the ventral diaphragm. Although able, like the reviewer, to find segmental innervation of the alary fibrils, the author could not trace the nerve further and writes ". . . we did not find any nerve cells connected with the innervation of the heart" in the mosquito (p. 46). It is especially interesting to note that she describes and figures the segmental cardiac nerve fibers (not cells) entering the heart of the crane fly, *Pachyrrhina cornicina,* and states that they form "varicose branchlets" on the heart wall. Such a finding in two members of the Nematocera should serve as a warning about broad generalizations, showing as it does that within the same family two different mechanisms can exist for regulating a common organ.

The physiological observations on the heart are all concerned with the reversal in the direction of the heart-beats, although she mentions in passing that she blocked the heart with atropine. In well-fed *Anopheles* she observed that forward beating of the heart predominated over backward (or reversed) beating. In dehydrated adults she found that almost exclusive forward beating occurred along with a lowered heart rate. She states that during egg laying the *Anopheles* heart beats backwards (from anterior to posterior end).

Iaguzhinskaia does not mention how she prepared the heart for dissection nor what saline or conditions she employed in her experiments on reversals of heart-beat. This is unfortunate because she mentions irregularity in beating and frequent cardiac arrest in her dissected preparations. She found that tergite movements were less frequent than heart contractions and states that ". . . each contraction of the alary muscles served as a stimulus arousing the automatism of the heart. . . ." This reviewer never observed rhythmical contractions of the alary muscles in a study on the heart of *A. quadrimaculatus.* Iaguzhinskaia proceeds to make an elaborate speculation about the influence of the nervous system on the alary muscles as they affect reversals of heart-beat. In brief, she proposes that there is a periodic reflex stimulation of the anterior and posterior alary muscles which thus bring about reversal of beats. She does not discuss the possibility that back-pressure could initiate backward beating. Experiments made by this reviewer (transection of the heart tube so that the anterior end beats backwards while the posterior end beats forward and reverses) would not seem to support her idea of a reflex stimulation of the alary muscles as the cause of beat reversal.—Jack Colvard Jones.

FOREMEN AND OPERATORS' MANUAL FOR RESIDUAL DDT SPRAYING—MALARIA CONTROL WORK IN TAIWAN, January 1954, 31 pp.; and PART "B"—

DDT Spraying—Foremen and Oporators' Guide, January 1954, 44 pp. Pastor S. Echavez (includes Chinese translation by Wan I. Ch'en). Published January 1954. (Publisher not given.) To quote from the Manual: "The purpose of this manual is to provide the foreman and the sprayer operator in the field a guide so that DDT spraying can be accomplished more effectively. It does not contain all details necessary to meet all kinds of situation, but basic principles are presented so that the operators can be guided in their work."

These two publications, which actually can be considered as two parts of one publication, are printed on alternate pages simultaneously both in English and Chinese. Both publications are illustrated with line drawings.

Although these publications are intended for the Chinese malaria personnel in Taiwan (Formosa) they are of interest to any person who has worked with residual house spraying programs. Local "color" is abundant with such statements as, "In localities where silkworm raising is of considerable importance, it may be necessary to adjust the spraying schedule so that the silkworm is not endangered." Even the Chinese proverbs are not forgotten and such quotes as "one note on paper is equal to ten thousand memories," are included.

The following are some of the items discussed: Description of the compression sprayer, how to prepare the DDT wettable powder suspension, how to spray, measurement of areas sprayed, records, personnel management, cleaning the sprayers, and the method by which DDT controls malaria. Appendices include "Community Spraying Schedule" and "Instructions for Spraying Public Buildings and Shops." Annex I of the first publication is entitled "The Arithmetic of Spraying Water Dispersible DDT Powder." It is a very useful annex and contains two tables.

Although the name of the publisher is not included, the copies provided this reviewer were received from the World Health Organization Team, Ch'ao-Chow, Ping-Tong, Taiwan (Formosa).—Donald R. Johnson, Div. of International Health, U.S.P.H.S., Washington 25, D. C.

The Use of Fogs and Mists for Adult Mosquito Control. Proceedings and papers of the Toledo Seminar of the American Mosquito Control Association held on September 29, 30, and October 1, 1954. Published by the Toledo Seminar Committee, 5015 Stickney Avenue, Toledo 12, Ohio. $1.00. The papers in the digest represent the work of several authors. Some are professional entomologists, some are practical mosquito control workers, and still others represent the manufacturers of adult mosquito control equipment. Seven papers are devoted to discussion of such basic mosquito control problems as administration, insecticide formulation, choice of proper equipment, and evaluation of work. The remaining twelve contributions delve deeply into the actual physical problems encountered during misting and fogging operations. Operational problems, safety precautions, communication, maintenance of equipment, and the relative costs of these operations are discussed in considerable detail in organized papers and in impromptu conversation. This digest is a contribution to practical mosquito control written at the layman's level. Although it is not a highly technical publication, it does contain a wealth of common-sense information.—Elinor G. Thomas, Toledo Area Sanitary District, Toledo 12, Ohio.

ANNOUNCEMENT OF ANNUAL MEETING

The 12th annual meeting of the AMCA is to be held at Beaumont, Texas, February 5–8, 1956. It is felt by the officers of the Association that this meeting will be one of the best ever held and will be well worth your consideration. Plan *now* to attend; mark your calendar, save your money, and bring as many representatives from your district as you can.

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